U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
PB-274 906

# Air Pollution Abstracts
# Vol. 1, No. 8

Environmental Protection Agency, Research Triangle Park, N C

1970

PB 274 906

Volume 1, No. 8
Abstracts 1779-2285

# NAPCA Abstract Bulletin

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Service

**TECHNICAL REPORT DATA**
*(Please read Instructions on the reverse before completing)*

| 1. REPORT NO. | 2. | 3. RECIPIENT'S ACCESSION NO. |
|---|---|---|
| APABCA-1-8-1970 | | PB 207 906 |

| 4. TITLE AND SUBTITLE | 5. REPORT DATE |
|---|---|
| Air Pollution Abstracts Volume 1, No. 8 | 1970 |
| | 6. PERFORMING ORGANIZATION CODE |
| 7. AUTHOR(S) | 8. PERFORMING ORGANIZATION REPORT NO. |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Air Pollution Technical Information Center<br>Research Triangle Park, North Carolina 27711 | 10. PROGRAM ELEMENT NO. |
| | 11. CONTRACT/GRANT NO. |
| 12. SPONSORING AGENCY NAME AND ADDRESS<br>Same | 13. TYPE OF REPORT AND PERIOD COVERED |
| | 14. SPONSORING AGENCY CODE |

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This periodical is published to inform air pollution personnel of the Environmental Protection Agency (EPA), and others, of technical literature recently accessioned by the Air Pollution Technical Information Center (APTIC). For each accession, its Abstract Number, APTIC accession number, bibliographic citation, and abstract are given. Translations are cited with their sources whenever possible. The subject fields are as follow: Emission Sources; Control Methods; Measurement Methods; Air Quality Measurements; Atmospheric Interactions; Basic Science and Technology; Effects-Human Health; Effects-Plants and Livestock; Effects-Materials; Economic Aspects; Standards and Criteria; Legal and Administrative; Social Aspects; and General and Miscellaneous. All abstracts are listed under one of the above subject fields. A subject and author index are included. This issue contains abstracts 1779 - 2235.

17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Air pollution<br>Abstracts<br>Information retrieval | | 13B<br>5B |

| 18. DISTRIBUTION STATEMENT | 19. SECURITY CLASS (This Report) | 21. NO. OF PAGES |
|---|---|---|
| Unlimited | | 145 |
| | 20. SECURITY CLASS (This page) | 22. PRICE PC A07 MF A01 |

EPA Form 2220-1 (9-73)

# NAPCA ABSTRACT BULLETIN

Prepared and Distributed by:

Office of Technical Information and Publications (OTIP)
Air Pollution Technical Information Center (APTIC)
National Air Pollution Control Administration (NAPCA)
1033 Wade Avenue
Raleigh, North Carolina 27605

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**U. S. Department of Health, Education, and Welfare**
**Public Health Service**
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# EMISSION SOURCES

1779 APTIC NUMBER 20068

Agnew, John T.
UNBURNED HYDROCARBONS IN CLOSED VESSEL EXPLOSIONS, THEORY VERSUS EXPERIMENT APPLICATIONS TO SPARK IGNITION ENGINE EXHAUST. SAE (Soc. Automotive Engrs.) Trans., 76(1):796-810, 1968. 11 refs. (Paper 670125.)

A complete theoretical analysis is presented of the amount of unburned hydrocarbons to be expected in the products of combustion in closed vessel explosions. Two cases are treated: rigid spherical cavities with central ignition, and the spark ignition combustion chamber. Experimental data are presented for the quench phenomenon as observed by the spark-ignition of propane mixtures in the center of various size spherical combustion bombs. Neither experiments with bomb size as the independent variable nor with initial pressure as the independent variable produced results consistent with those predicted by quench theory. More consistent results were obtained when the pressure dependency of the quenching distance was revised to accomodate the high pressures encountered in a constant volume combustion process. The measured concentrations of unburned hydrocarbons were lower than those predicted by theory because the hydrocarbons produced in or near the quenched layer continue to react during a post-flame homogeneous reaction. A modified quench theory that takes this factor into account permits calculations which are in agreement with normally observed values. The theory indicates that a large-displacement low-compression ratio engine would produce an exhaust with a much lower concentration of unburned hydrocarbons than a small-displacement high-compression ratio engine.

1780 APTIC NUMBER 17906

Agnew, W. G.
AUTOMOTIVE AIR POLLUTION RESEARCH. Proc. Roy. Soc. (London), Ser. A., 307(1489):153-181, Oct. 1968. 68 refs.

Some of the progress which has been made in the United States toward the objectives of automotive air pollution research with respect to photochemical smog, carbon monoxide, polynuclear aromatic hydrocarbons, lead, and diesel smoke and odor are reviewed and discussed. Automotive air pollution research has as its objectives: (1) to understand the nature of the atmospheric effects; (2) to understand the nature of vehicle emissions; and (3) to develop concepts for the control of significant pollutants. Attempts to determine the magnitude of hydrocarbon and nitrogen oxide emissions from vehicles immediately face two severe difficulties: (1) automobiles are operated in an almost infinite variety of steady-state and transient driving conditions, ambient conditions, and states of repair; and (2) the exhaust is made up of hundreds of individual compounds with different degrees of significance and the proportions of these compounds vary with operating conditions and fuel types. The estimated contributions of the engine crankcase, exhaust, and carburetor and fuel tank to the hydrocarbon and nitrogen oxide emissions from an average uncontrolled vehicle are presented. Numerous charts and illustrations are given. Polynuclear aromatic hydrocarbons and lead in the atmosphere appear to be below the levels of any health hazards, but information in this area, as well as understanding of the vehicle emissions of these materials, is inadequate. Diesel smoke is currently a commercial economic problem requiring legal enforcement, but its odor remains a chemical mystery.

1781 APTIC NUMBER 20835

American Industrial Hygiene Assoc., Detroit, Mich., Hygienic Guides Committee
ETHYLENE DIAMINE (1,2-DIAMINOETHANE) H2N-CH2-CH2-NH2 (REV. 1969). Am. Ind. Hyg. Assoc. J., 31(1):113-115, Feb. 1970. 10 refs.

The significant physical properties of ethylene diamine are presented, along with allowable atmospheric concentration limits, toxic properties, its industrial use, methods of determining its concentration in the atmosphere, hazards associated with its use, and medical treatment information. Principle toxic reactions to inhalation include kidney injury, lung injury, liver injury, and loss of hair. Protective clothing and goggles are recommended. For high atmospheric concentrations, an amine cannister gas mask is specified. Because of its low flash point, fire and explosion precautions are mandatory.

1782 APTIC NUMBER 20837

American Industrial Hygiene Assoc., Detroit, Mich., Hygienic Guides Committee
HYDROGEN CYANIDE (HYDROCYANIC ACID, PRUSSIC ACID) HCN (REVISED 1969). Am. Ind. Hyg. Assoc. J., 31(1):116-119, Jan-Feb. 1970. 10 refs.

The significant physical and toxic properties of hydrogen cyanide are listed. Recommended maximum atmospheric concentration for eight hours is given as ten parts of vapor per million parts of air by volume. Short exposure tolerance indicates that concentrations of eighteen to thirty six parts per million may result in some symptoms after an exposure of several hours. Concentrations immediately hazardous to life are given as two hundred seventy parts per million as immediately fatal to man; one hundred eighty one parts per million fatal after ten minutes; one hundred thirty five parts per million fatal after thirty minutes; and one hundred ten parts per million fatal after one hour. Toxic properties include cellular anoxia, inhibition of enzyme systems, weakness, headaches, alterations of respiratory pattern to sudden collapse, and death. Industrial uses of hydrogen cyanide include production of acrylonitrile, electroplating, mining, and use as a fumigant. Air sampling in the field is done with detector tubes and crayons, while in the lab test papers, mass spectroscopy, gas-liquid chromatography, and several chemical methods are available. Recommended controls of hazards are given, along with emergency and special medical treatment.

1783 APTIC NUMBER 20182

Austin, A. T.

THE CHEMISTRY OF THE HIGHER OXIDES OF NITROGEN AS RELATED TO THE MANUFACTURE, STORAGE AND ADMINISTRATION OF NITROUS OXIDE. Brit. J. Anaesthesia (Altrinham), vol. 39:345-350, 440-444, May 1967. 10 refs.

Nitrous oxide for anesthetic purposes is commerically produced by heating ammonium nitrate to 245-270 deg; and current practice for removing nitric oxide, nitrogen dioxide, and nitrogen from N2O varies from a series of gas washings with a crude fractionation of the liquefied gas to a scrubbing with scavenging in a moist iron bed. Nitric oxide is the most likely toxic contaminant, but the concentration in the effluent gas from a cylinder diminishes rapidly due to fractionation, and the velocity of the reaction with oxygen is very slow at concentrations below about 0.1 per cent. Most methods of detection and estimation of NO depend upon prior oxidation. Reaction between nitrogen dioxide and water is complex, and toxic effects result from the formation of hydrogen ions, NO, nitrate and nitrate ions. (Author summary modified)

1784 APTIC NUMBER 20118

Barnes, Gerald J.
RELATION OF LEAN COMBUSTION LIMITS IN DIESEL ENGINES TO EXHAUST ODOR INTENSITY. SAE (Soc. Automotive Engrs.) Trans., 77(3):1706-1725, 1969. 19 refs. (Paper 680445.)

Exhaust gas odor threshold dilution ratios were determined by a single panelist using the Sniff-Mask technique during idle operation of a single-cylinder 4-stroke cycle diese engine using n-heptane as a fuel; the effect of various changes in the intake atmosphere composition on odor thresholds was determined. The substitutions of argon and helium for the nitrogen in the normal intake air produced a 15-fold reduction in the exhaust odor thresholds, while the substitution of carbon dioxide increased the odor threshold by a factor of 4. Changes in the intake atmosphere composition altered the diffusional mixing processes, the fuel spray patterns, the compression and combustion temperatures, and the combustion limits within the combustion chamber. A good correlation was found between the measured exhaust odor thresholds and the lean flammability limits of pre-mixed flames determined in the intake atmospheres used suggesting that diesel odor is caused by odorous products of partial oxidation that are produced in regions of fuel/oxidizer mixtures too lean to burn at the start of combustion. (Author abstract modified)

1785 APTIC NUMBER 17839

Bartalini, E. and G. Cavagna
PROBLEMS OF INDUSTRIAL HYGIENE IN THE USE OF THE SPRAY TECHNIQUE WITH PLASMA TORCHES. (Problemi di igiene industriale nell'applicazione della tecnica di spray con torce al 'plasma'). Text in Italian. Med. Lavoro, 57(4):286-290, April 1966. 15 refs.

A new technique, still in the experimental phase, is described, for using a plasma torch for the spraying of metal particles to obtain a protective coating that is heat-resistant, antioxidative, electrically insulating, and resistant to corrosion and wear. The occupational hazards of such a process are the liberation of gaseous nitrogen compounds (nigrogen dioxide as high as 9 ppm at 500 cm) and ozone (0.5-1.0 ppm), intense ultraviolet radiation, and the production of a painfully high noise level. Also a potential danger are the metallic particles (cobalt, titanium, tungsten, and tantalum carbides, metallic Al), known to be responsible for pulmonary fibrosis. Preventive measures suggested are the use of evacuation hoods (delivering 20 cu/min/sq m of working area) and the wearing of suitable protective equipment, which would include leather gloves and apron and a welder's helmet with an anti-actinium window.

1786 APTIC NUMBER 17943

Belov, K. A. and L. N. Petrova
REDUCING BENZOLE HYDROCARBON LOSSES TO ATMOSPHERE. Coke Chem. (USSR) (English translation from Russian of: Koks i khim.), no. 9:32-36, 1968.

The saturated vapor pressures and volality of crude benzoles and rectification products at two coke and chemical works were experimentally determined. The saturated vapor pressures were determined at temperatures between -15 and +30 C. A three-neck flask was used which was controlled by a thermostat to maintain a constant temperature. When the required temperature was reached, 10 ml of the test substance injected into the flask and the pressure change recorded. The relationship between saturated vapor pressure and temperature was described by the equation lgP equals A - B/T, where P is the pressure of the saturated vapor in mm Hg, T the temperature in degrees Kelvin, and A and B are constants which were found experimentally. Benzene hydrocarbon losses through the breather valves in storage tanks are largely governed by the rate at which the latter are charged and the speed at which the air space in the tanks becomes impregnated with hydrocarbon vapors. To determine the quantity of these losses, 250 ml of benzene was poured into a vessel, the proper temperature was adjusted, and atmospheric air was allowed to enter. The escaping hydrocarbon vapors were caught by activated charcoal. The increase of weight of the activated carbon divided by the volume of air expelled by the vapors from the vessel yields the amount of hydrocarbons lost from the container. The error of this method did not exceed 0.5%.

1787 APTIC NUMBER 20020

Bonnet, J.
QUANTITATIVE ANALYSIS OF BENZO(A)PYRENE IN VAPORS COMING FROM MELTED TAR. Nat. Cancer Inst. Monograph, no. 9:221-223, 1962. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

The atmosphere breathed by workmen melting coal tar (at temperatures of 220-310 C) and carrying the melted tar in containers (temperatures 180-210 C) was analyzed for

benzo(a)pyrene content. These conditions were simulated by heating, 1 kg of tar to 200 and 300 deg and collecting vapors 20 cm from the surface of the samples. The solid tar contained 1.0% benzo(a)pyrene; at 200 deg. the vapors contained 0.05-0.6% benzopyrene; at 300 deg, the vapors contained 4.3-4.4% benzopyrene. Further tests were conducted in the actual work situation. Workmen around the large container inhaled 2.48 mg benzopyrene per hour when the tar was 310 deg, and 0.81 mg when the temperature was 270 deg. Workmen applying the tar to a surface would inhale 0.26 mg. Workmen levelling the surface of tar at a temperature of about 20 deg would inhale 0.32 mg. Analysis was by column chromatography over alumina, and was accurate to plus or minus 5%.

1788 APTIC NUMBER 17903

Burt, E. and A. Thomas
AEROSOL POLLUTION FROM INTERNAL COMBUSTION ENGINES. Proc. Roy. Soc. (London), Ser. A., 307(1489):183-194, Oct. 1968. 16 refs.

Each type of internal combustion engine to the extent to which it pollutes the air with aerosols is reviewed and each type of pollutant is considered. Specifically, the petrol engine, the diesel engine, and the aircraft turbojet engine are briefly discussed. The barium salts, photochemical smog, mists from diesel engines, black smoke, diesel fuel additives, and jet fuel factors are presented. The diesel, or compression-ignition, engine contributes towards atmospheric pollution mainly through its exhaust system, 'white smoke', 'blue smoke' and 'black smoke' being recognized as aerosol pollutants. White smoke is the results of poor combustion or the complete absence of combustion in the cylinder. It is most prone to occur following starting when the engine is cold. Black smoke may be emitted from diesel engines at high load conditions, particularly if the engine is over-fueled or in poor condition. Certain fuel additives which reduce black smoke emission have recently become available. These generally contain barium compounds so that when these additives are used, barium salts will appear as particulate matter in exhausts. Legislation, such as that proposed in the United Kingdom, will restrict maximum diesel engine power ratings to levels which give less smoke than at present. The survey shows that technological solutions to the problems of aerosol pollution by the internal combustion engine exist, at least in principle. They may involve equipment development, fuel development, or a combination of both.

1789 APTIC NUMBER 18182

Clement, J. L., J. H. Coulter, and S. Suda
B AND W KRAFT RECOVERY UNIT PERFORMANCE CALCULATIONS. Tappi, 46(2):153A-160A, Feb. 1963.

Calculations used commercially to determine a material and heat balance for a kraft recovery unit are described. The application of recovery-unit design in the calculation procedure which is based on elemental liquor analysis, permits accurate prediction of unit performance. A material and heat balance can be calculated from elemental analysis for all pulp-mill recovery systems. The procedure described is particularly valuable in calculating the expected thermal performance of recovery units processing sodium-base liquors differing in properties from kraft liquor. An example is a unit burning neutral sulfite semichemical liquor to produce a high-sulfidity smelt with low reduction relative to kraft. The procedure is applicable to the design of recovery units processing magnesium, calcium, and ammonium-base liquors. This has been done successfully in predicting the performance of magnesium-base recovery units by analyzing the calorimeter bomb products of liquor combustion to permit calculating a heat-of-reaction correction.

1790 APTIC NUMBER 20058

Cortecci, G. and A. Longinelli
ISOTOPIC COMPOSITION OF SULFATE IN RAIN WATER, PISA, ITALY. Earth Planet. Sci. Lett., 8(1):36-40, 1970. 15 refs.

The content of the isotopic oxygen and isotopic sulfur in rainwater sulfate was measured from August 1968 to July 1969. The analysis of isotopic oxygen was performed by the graphite reduction technique, and carbon monoxide was converted to carbon dioxide by a high voltage glow discharge between platinum electrodes. Sulfur analysis followed the technique of Rafter. Oxygen measurements are plotted against standard mean ocean water and sulfur measurements are against the meteoritic sulfur standard. The main source of sulfate in Pisa rain water is probably the atmospheric oxidation of $SO_2$ derived from industrial waste. The range of oxygen values is greater than that of sulfur values and indicates an apparently seasonal variation. The winter samples have a low content of oxygen 18, both in the water and in the dissolved sulfate. The $S^{34}$ content in sulfate samples is about 20‰ lower than that of the sulfate in sea water, so that the contribution of sulfate from the Tyrrhenian Sea, 9 km from Pisa, can be discounted.

1791 APTIC NUMBER 18176

Dillard, J. K., and C. J. Baldwin
UTILITIES SEEK TO OPTIMIZE ENERGY ECONOMICS. Elec. Light Power, p. 84-87, April 1965.

Present trends indicate that there will be increased usage of mine-mouth plants, EHV transmission, and nuclear generation. Pooling will take place on a regional basis with an upper limit of transmission distance of 500 to 700 miles. Economies will be realized by locating a large portion of the installed capacity relatively near the load centers. Large nuclear plants will be applied in areas with fuel costs in excess of $0.25 per million Btu. Competition from nuclear plants and regional mine-mouth plants will exert continued downward pressure on coal costs and rail rates. Studies of the economics of pooling have shown savings from common economic dispatch and two-way energy transfer that have amounted to about 3% of the total fuel bill and investment charges on the bulk power systems of the pooling utilities. The trend toward larger plant sizes has helped to establish a competitive advantage for nuclear power where fuel costs exceed $0.25 per million Btu, since these plants enjoy an economy of scale beyond that of conventional plants. The slightly higher initial cost of nuclear power plants is offset by the

progressively lower fuel-cycle costs encountered. The distances over which pooled power blocks can be economically transmitted depends on the type of generation, plant size, the line voltage used, and fuel costs in the relative areas. Fuel cost vs transportation distance curves are shown. Several practical examples of economical pooling are given.

1792 APTIC NUMBER 17910

Dumont, A. H. and J. L. Gulette
ENERGY PRODUCTION UNITS OF THE 'TURBO-JET' TYPE. (Les groupes de production d'energie du type 'turbo-jet'). Text in French. Bull. Soc. Roy. Belge Electriciens, 85(1):21-37, Jan.-March 1969. (Presented at the Societe royale belge des Electriciens a Bruxelles, Jan. 23, 1969.)

A brief, general description is given of 20- and 40-megawatt electric power stations using turbo-jet type aviation gas turbines with direct-driven alternators, installed at Langerbrugge (Belgium) and at Beerse (Belgium) respectively. Schematic sectional views and photographs of the exterior views of these stations are shown. The environmental problems posed by the turbo-jet units are discussed, as well as their typical applications. The electrical control circuits and the operational characteristics of the turbo-jet electric power stations, the economic aspects of their use, as well as their applications as back-up units in electrical networks, emergency power units, and as a 'cold reserve' in electrical installations are presented. The environmental aspects considered in detail are acoustical vibrations, mechanical vibrations, and smoke emission. As these power stations are located in residential districts, the above factors are highly important. High-frequency noise is generated in the compressor stage by the motion of the rotor blades past the stator blades and emerges largely through the air intake. Low-frequency noise is generated in the combustion chamber and high-frequency noise, from the gas turbine emerge through the gas outlet. High-frequency sound is emitted by the housing of the unit. The elaborate sound absorption measures are described and the vibration-isolating mounting of the unit are discussed. When natural gas is used as fuel, no smoke is formed. Light virgin naphtha used in Belgium gives less smoke than kerosene. Changes in existing combustion-chamber designs resulted in reduced smoke emission.

1793 APTIC NUMBER 20863

Gambs, Gerard C.
THE ELECTRIC UTILITY INDUSTRY: FUTURE FUEL REQUIREMENTS 1970-1990. Mech. Engr., 92(4):42-48, April 1970.

By 1990, the thermal generating capacity of power plants will have increased from 270 million kw in 1970 to over 1100 million kw. The generation of electricity in 1990 will be four times the 1970 generation, and the total fuel requirement by 1990 will be nearly five times that of the current level. The types of fuel which will be consumed in the 1970-1990 period are discussed. Due to anticipated shortage of coal, consumption of coal by electric utilities will peak out at 315 million tons by 1975 and then decline to 226 million tons by 1990. Because of the availability of oil, and the cost advantage of burning oil instead of coal, oil consumption will grow from the current level of 250 million bbl per year to 644 million bbl per year by 1990. Current consumption of natural gas is now about 3000 billion cu ft per year and should continue to increase to 6100 billion cu ft per year by 1990. Hopefully, nuclear shots for gas stimulation will increase gas reserves. It is believed that nuclear power will grow from the current level of several million kw to nearly 200 million by 1980 and to 600 million kw by 1990. The advantages of utilizing uranium ore as a fuel is indicated by the fact that it takes 17000 tons of coal to equal one ton of uranium oxide concentrate in energy equivalent.

1794 APTIC NUMBER 18169

Gauvin, W. H., and J. J. C. Gravel
CHEMICAL RECOVERY FROM SULFITE SPENT LIQUORS BY THE ATOMIZED SUSPENSION TECHNIQUE. Tappi, 43(8):678-683, Aug. 1960. 9 refs.

The pyrolysis of neutral sulfite semichemical (NSSC) spent liquors under reducing conditions yields a solid product consisting essentially of sodium carbonate with small amounts (usually less than the originally present in the liquor) of sodium sulfate. Preliminary studies have indicated that sodium carbonate can be recovered with yields of 90% and better. Combustible gases are produced of good calorific value from which the sulfur can be recovered as SO2. In this report the engineering aspects of this technique are presented. A corrosion study has shown that austenitic stainless steels are strongly attacked by fused sodium carbonate, and experimental data is presented both above and below the fusion temperature (765 C) and for a wide range of residence times. Reactor pressures of up to 60 psi are used for feed concentrations of 55%, and the results indicate that adequate sodium carbonate conversions can be obtained at wall temperatures below the fusion point. (Author's abstract modified)

1795 APTIC NUMBER 17840

Gerlovin, L. I. and V. P. Sigachev
BOILER WITH HIGH DEGREE OF EXHAUST GAS UTILIZATION. (Kotel s glubokoy utilizatsiyey tepla vykhlopnykh gazov). Text in Russian. Sudostroenie, no. 10:32-34, Oct. 1968.

The boiler installation of the tanker Velikiy Oktyabr' is described. Some operating parameters are as follows: working pressure in separator, 9-10 kg/sq cm; temperature of superheated steam, 290-295 C; steam production under intermediate load, 3660 kg/hr; hydrodynamic drag, about 3.0 kg/sq cm; and resistance of gas channel, about 110 mm H2O. A circulation factor of about 3 was dictated by a tendency toward an increased temperature head due to a reduction in temperature of the circulating water to minimum (based on low-temperature corrosion considerations). Exhaust gas temperature (180 C) is determined by conditions designed to assure a minimum temperature drop of approximately 30 C between the gas and wall at the inlet under operating conditions.

1796 APTIC NUMBER 20164

Goroshko, B. B., G. A. Panfilova, R. S. Gil 'denskiol'd, and B. V. Rikhter.
RESULTS FROM STUDIES OF NITROGEN OXIDE AIR POLLUTION FROM A CHEMICAL PLANT. (Rezul 'taty nablyudeniy za zagryazneniyem atmosfery okislami azota ot khimicheskogo zavoda). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 185:63-67, 1966. 10 refs.

The emissions from a 100-m high 1.6-m diameter stack were measured with an Assman psychrometer at heights of 0.2, 0.5, and 2 meters. Wind speed was determined at heights of 0.25, 0.5, 1.2, 2, and 4 m and in the surface layer with contact anemometer. Atmospheric probes were made to heights of 500-1000 m by aerostat and helicopter. Emissions generally ranged from 70 to 100 g/sec and were 15-20 C warmer than the surrounding air. Concentration of nitrogen oxides was measured by various methods at a height of 1.5 m at ten points along the pluse path up to distances of 3 km. Experimental results substantiate existing theoretical models relating effective stack height and pollutant concentration to wind speed at distances of 2 and 3 km. The so-called hazardous wind speed at these distances proved to be around 1-2 m/sec.

1797 APTIC NUMBER 17951

Haynes, C. D. and M. Southall
ATMOSPHERIC POLLUTION FROM PETROL ENGINES. BASELINE EXHAUST EMISSIONS OF VEHICLES TESTED TO THE DRAFT EUROPEAN PROCEDURE. Motor Industry Research Association, Nuneaton England, Rept. 1968/5, 41p., Feb. 1968. 8 refs.

Approximately 100 cars, representative of the age and engine capacity distribution of the current car population in Great Britain, were subjected to the European draft method of testing for the purpose of establishing baseline emissions for motor vehicles. Average carbon monoxide emissions from a cold start was established at about 3.4%, with a range of 0.6 to 7.4%; average hydrocarbon emissions was established at 705 ppm from a cold start. Simple engine maintenance (correction of ignition faults, carubretor adjustment) resulted in a 20% reduction in average CO emissions and 10% reduction in hydrocarbon emissions. Hot idle emissions ranged from 0.2 to more than 11.6% CO with an average of 6.1%; average hydrocarbon emissions was 1550 ppm. Engine tuning reduced these averages by 29 and 40%, respectively. Comparisons were made between the European and U. S. Federal test procedures, but no correlations could be drawn.

1798 APTIC NUMBER 20011

Johnson, J. E.
NUCLEAR SUBMARINE ATMOSPHERES. ANALYSIS AND REMOVAL OF ORGANIC CONTAMINANTS. (INTERIM REPORT). Naval Research Lab., Washington, D. C., Chemistry Div., NRL Problems C08-30 and R05-24B, Projects SF 013-0n-03-4092-4093-4094-4095 and RR 011-03-41-6059, NRL Rept. 5800, 10p, Sept. 10, 1962. 19 refs.
DDC: 285269

Beginning with the first long submergence of the Nautilus in the spring of 1956, a fairly continuous atmosphere analysis program for organic constituents has been carried on in the nuclear submarine fleet. The program is based on the exposure of carbon canisters and subsequent recovery of hydrocarbons by steam desorption. The composition of the organic mixture in the atmosphere is very complex and is predominantly hydrocarbon in nature. The total hydrocarbon content of submarine atmospheres initially was very high (100 to 200 mg/cu m). In one incidence, paint solvents contributed significantly to the hydrocarbon contamination. A sudden drop of measured hydrocarbon concentrations was puzzling and it is feared that loosly filled canisters may have given low results. It could also be due to strict control of sources of contamination. Recently, individual aromatic hydrocarbons in oils recovered from submarines were analyzed. For this purpose, the hydrocarbon sample was separated by liquid chromatography on silica gel into three hydrocarbon type fractions: saturates, olefins, and aromatics. Between 36 and 54% of the aromatics were found in the oils. Several additional samples contained 25 to 30% aromatics. The most useful means of removing organic contaminants from the submarine atmospheres are combustion by hopcalite catalyst and adsorption by activated carbon contained in large filter beds. The concurrent effect of the CO/H2 burner and the carbon bed is demonstrated by resorting to an idealized model.

1799 APTIC NUMBER 17883

Kiss, Istvan
INDUSTRIAL METHODS FOR ENRICHMENT OF U-235. (Az U-235 dusitasanak ipari modszerei). Text in Hungarian. Energia Atomtech. (Budapest), 11(7-8):466-473, 1958.

Various methods are reviewed for increasing the U-235 concentration of uranium ore. The various procedures for separating a particular isotope include distillation, chemical reaction, thermal diffusion, electrolysis, gas diffusion, and the ultracentrifuge; however, the two last-mentioned methods have been found by statistical studies to be the most suitable. In addition to a study of the theoretical principles of gas diffusion and centrifugation, the isotope enrichment is discussed. Formulas are given for the time required for a cascade to reach equilibrium and for the amount of power required to operate the gas diffusion cascade. The gas diffusion method of separating uranium isotopes uses uranium fluoride (UF6), which sublimates at 56 C. Only one isotope of fluorine occurs naturally, so that the UF6 molecule will have a weight of either 352 or 349, if one neglects the 0.005% content of U-234 that occurs naturally in uranium ore. When the K25 type of diffusion plant is used, the pressure of the entire system has to be kept below atmospheric pressure for the following reasons: the smaller the pressure, the larger the enrichment factor, due to the longer free path of the molecules; there is less possibility of an impact between the UF6 and the tubing; and if a leak were to develop in the equipment, the UF6 would not escape. Uranium fluoride is in itself a poisonous compound, and when diluted by the atmosphere, it is prone to react with the moisture in the air to form hydrogen fluoride gas.

1800 APTIC NUMBER 20105

Korth, W. W. and A. H. Rose, Jr.
EMISSIONS FROM A GAS TURBINE AUTOMOBILE. SAE (Soc. Automotive Engrs.) Trans., 77(2):1327-1338, 1969. 8 refs. (Paper 680402.)

Exhaust emissions were measured from a Chyrsler gas turbine automobile operating on the road and on the dynamometer. Emissions measured both as mass and as concentration were considerably lower than those from a conventional automobile. Two different fuels were used, and tests were made after both hot and cold starts. Mass emission levels expressed as a percent of the emission levels from the conventionally powered car were 15% for hydrocarbon, 8% for carbon monoxide, and 77% for nitrogen oxides when the turbine vehicle used diesel fuel; the values were 24% for HC, 6% for CO, and 84% for NOx when the fuel used was gasoline. Emission levels for dynamometer tests indicated the same low trends. Concentrations using diesel fuel were 42 ppm (Hexane) for HC and 0.20% for CO, while concentrations for the car using gasoline were 63 ppm (Hexane) HC and 0.16% for CO. Composition of the hydrocarbon in the exhaust emission of the turbine-powered car generally reflected the structure of the fuels being burned.

1801 APTIC NUMBER 20127

Kruse, Ronald E. and Donald M. Hill
EXHAUST EMISSIONS FROM COMPACT CARS. SAE (Soc. Automotive Engrs.) Trans., 76(3):2247-2257, 1968. 11 refs. (Paper 670688.)

Emission data were obtained for 30 imported compact cars and 21 domestic cars in road tests over a typical urban route and in chassis dynamometer tests with the California 7-mode cycle (hot start). The test fleet was designed to represent the same relative proportion of makes of compact cars that occur in the total car population. Test data were statistically analyzed and are summarized in tables and graphs indicating mean and mass emissions, dynamometer emissions vs road emissions, concentrations vs engine displacement, concentrations vs engine weight, and mean exhaust flow. Hydrocarbon and carbon monoxide emissions are compared with those for standard cars. On a concentration basis, hydrocarbon and carbon monoxide levels from imported compacts are not significantly different than those for standard cars. Hydrocarbon and carbon monoxide emissions from domestic compacts are 1.49 and 1.51 times as high, respectively, as those from standard cars. Results of the dynamometer tests show that, on a concentration basis, reductions of hydrocarbons to meet the 1968 Federal standards are about twice as high for compact as for standard cars. Since the road data show that the mass hydrocarbon emissions are about the same for both types of cars, emission standards based on equal mass emissions for all sized cars would be more equitable.

1802 APTIC NUMBER 18184

Leroy, J., and P. J. Lenoir
HOBOKEN TYPE OF COPPER CONVERTER AND ITS OPERATION. Preprint, Institution of Mining and Metallurgy, London, 11p., 1967. (Presented at the Advances in Extractive Metallurgy Symposium, London, April 17-20, 1967. Paper 15.)

Copper converting gives off large quantities of sulfur gases. With standard converters blowing in a hood, serious dilution of gases is unavoidable, and the sulfur is only partially recovered. The siphon converter was developed to eliminate dilution of gases by maintaining a constant zero draught at the converter mouth by means of a variable-speed fan and adequate dampers. The dampers are electrically interconnected, as are the fans and the dampers. This insures that gases containing SO2 cannot be released directly into the stacks. Disadvantages of the siphon converter are a greater initial capital outlay, the greater amount of ground space required, and a fairly heavy counterweight that is used to compensate for the weight of the siphon. Mathematical comparisons are made between a conventional converter and a siphon converter.

1803 APTIC NUMBER 18188

Lewis, E. C., and R. G. Tallent
CHEMICAL RECOVERY UNIT. (Combustion Engineering, Inc., Windsor, Conn.) U. S. Pat. 3,304,918. 5p., Feb. 21, 1967. 3 refs. (Appl. Dec. 29, 1965, 2 claims.)

A new chemical recovery unit for employment in the kraft pulping process is described. The unit consists of an upright furnace into which black residual liquor is introduced for burning and smelting. The furnace has an inner surface lined with tubes designed to generate steam of at least 900 psi. The inner surface also has primary air induction ports spaced above the furnace bottom for directing air inward toward the combustibles on the bottom of the furnace. Smooth metal tubes are welded to the steam generating tubes for the purpose of securing a layer of molten chemicals. During the operation of the chemical recovery unit, molten chemicals are collected at the bottom of the furnace and are periodically withdrawn through a suitable spout.

1804 APTIC NUMBER 20125

Lienesch, John H. and Wallace R. Wade
STIRLING ENGINE PROGRESS REPORT: SMOKE, ODOR, NOISE AND EXHAUST EMISSIONS. SAE (Soc. Automotive Engrs.) Trans., 77(1):292-307, 1969. 17 refs. (Paper 680081.)

The Stirling engine is a closed cycle external combustion engine that differs from most heat engines in that energy is added to and withdrawn from the working fluid through two multitube heat exchangers, i.e., the heater and the cooler. Thermal energy can be supplied to the heater from practically any high-temperature source. Measurements made on a 1[illegible] hp single cylinder engine operating on diesel fuels indicate that it is unobjectionable with regard to smoke, odor, and noise. No smoke was detected at engine speeds of 3000 rpm at idle half-load, or full load. Exhaust odor was undetectable at concentrations normally encountered in the atmosphere. When observed at 100 ft, the Stirling unit was 21 db quieter than a standard internal combustion unit. The levels of unburned hydrocarbons and carbon monoxide in Stirling engine exhaust are two orders of

magnitude less than the 50 ppm value for hydrocarbons and the 0.5 value for carbon monoxide that may be established for new internal combustion engines. Emissions of nitrogen oxides are the same order of magnitude as those for a spark ignition engine. These can be reduced at the expense of engine thermal efficiency by lower combustion air-inlet temperature, leaner air-fuel ratios, and an exhaust gas recirculation system.

1805 APTIC NUMBER 20019

Lyons, ". J.
COMP' SON OF AROMATIC POLYCYCLIC HYDROCARBONS FROM GASOLINE ENGINE A" IESEL ENGINE EXHAUSTS, GENERAL ATMOSPHERIC DUST, AND ..ARETTE-SMOKE CONDENSATE. Nat. Cancer Inst. Monograph, no. :193-199, 1962. 14 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

An analysis was made of exhaust particulates from gasoline and diesel vehicles and a sample of general atmospheric soot, collected over a 3-month winter period in central Glasgow. The content of aromatic polycyclic hydrocarbons was compared with that of cigarette-smoke condensate. Qualitatively, the results were similar, but the quantitative differences were considerable. Pyrene, for instance, was disproportionately high for diesel exhaust, the benzo(a)pyrene content for gasoline soot was about 3 times as high as that of atmospheric soot and over 30 time as high as that of diesel soot, while dibenzo(a,l)pyrene was completely absent from atmospheric soot, but was found in the diesel and gasoline samples.

1806 APTIC NUMBER 20196

MacCollom, George B.
SAMPLING FOR DRIFT RESIDUES. Agrichem. West, May 1969:10,12,14.

In Vermont, the movement of pesticide particles from target areas to neighboring forage fields is a problem for both dairymen and orchardists. Proper conditions for the air application of pesticides were determined by investigating the effect of air-flow patterns on a slope of land where forage residue was contaminated by dust drifts. Filter papers were exposed in several downslope and downwind sampling sites. Examination of the papers, which permit determinations of residues without the necessity of laborious forage sample analyses, showed that the greatest concentration of residues (.18 micron) was on a straight downwind-downslope path. Measurements of particle count and size, obtained by pumping air through filters simultaneously at two sampling stations, revealed that the amount of insecticide in the air was greater than that being deposited on the filters. Sampling during an inversion further confirmed the downslope movement of particles, while sampling during a wind velocity of 10-12 miles/hr indicated that turbulence and velocity have a diminishing effect on particulates. It is suggested that pest control materials be applied during wind velocities of four to five miles/hr and in absence of inversions.



1807 APTIC NUMBER 20233

McKee, Herbert C.
STATIONARY ENGINES-AIR POLLUTERS OR NOT? Preprint, American Society of Mechanical Engineers, New York, 7p., 1969. 1 ref. (Presented at the American Society of Mechanical Engineers, Diesel and Gas Engine Power Division Conference, Kansas City, Mo., April 20-24, 1969.)

Factors affecting the emission of contaminants from internal-combustion engines are discussed as an aid in understanding the problems which might occur with stationary engines. One of the major differences between vehicular emissions and emissions from stationary engines is in operating characteristics. Some typical values are tabulated. It appears that fuel vapor emissions are less than with automobiles, in proportion to either the size of the engine or the amount of fuel used. Available information indicates that diesel engines, both vehicle and stationary, are only a very minor source of hydrocarbon vapor emissions. Stationary engines are probably not important as a source of carbon monoxide, except in the immediate vicinity of an engine which is not operating properly. Since many engines are run consistently under high speed and load conditions, this would tend to increase the emission of nitric oxide as compared to typical vehicular operations. Solid particles in the exhaust from stationary engines are likely to be negligible, with two possible exceptions. Sulfur compounds are normally not a problem, since the sulfur content of gasoline and other fuel used in internal combustion engines is usually low. It is concluded that the emissions most likely to be objectionable from the standpoint of air pollution are the oxides of nitrogen.

1808 APTIC NUMBER 20066

Ministry of International Trade and Industry (Japan), Public Nuisance Section
GENERAL PRELIMINERY INVESTIGATION OF INDUSTRIAL PUBLIC NUISANCE. (Sangyo Kojin sogo jizen chosa). Text in Japanese. Kankocho Koqaisenmon Shiryo (Public Nuisance Gaz.), 4(6):14-21, 60, Nov. 1969.

Air and water pollution were surveyed to obtain dat[illegible] f a pollution control program. Sulfur oxides content [illegible] air B.O.D. or C.O.D. and S.S. (?) and oil content of water were measured at major industrial areas. The objective was to determine contamination conditions for an area as a whole and not merely contamination around an individual factory. The following methods were employed for air pollution evaluation: tracer experiments; field measurements of diffusion conditions; wind tunnel test; and theoretical calculations of diffusion. The water pollution analysis involved investigations of sea conditions; field tracer experiments; a model test; and the construction of concentration thickness distribution maps. According to the rate of the contaminant discharged, factories were urged to increase chimney height or install multiple chimneys, utilize a better-quality fuel, improve drainage equipment; or modify plant layout. Practical examples of the survey are given. Use of a large-scale digital computer to simulate the diffusion of pollutants in the atmosphere is described, together with other plans being contemplated by the Ministry.

1809 APTIC NUMBER 20126

Newhall, H. K. and E. S. Starkman
DIRECT SPECTROSCOPIC DETERMINATION OF NITRIC OXIDE IN RECIPROCATING ENGINE CYLINDERS. SAE (Soc. Automotive Engrs.) Trans., 76(1):743-762, 1968. 35 refs. (Paper 670122.)

A theoretical and experimental investigation was carried out to determine the mechanism whereby nitric oxide is formed, conserved, and exhausted from the reciprocating engine combustion chamber. The equipment utilized a magnesium oxide window to transmit the infrared radiation from the combustion chamber, a monochrometer to disperse the radiation, and a cryogenically cooled semiconductor to sense and indicate the nitric oxide produced radiation. A single cylinder, variable compression ratio CFR engine was used with modifications: a dual ignition system was employed to insure simultaneous arrival of the flame front at all points along the optical path, and engine loading was provided by an eddy-current brake. Based on the application of theoretical chemical kinetics to measured experimental data, it may be concluded that freezing of nitric oxide concentrations occurs on a local basis substantially earlier than the point of overall peak cycle temperature. The average or bulk peak cycle temperature appears to be an inadequate representation of that state giving rise to the maximum equilibrium NO concentration, and calculation of maximum equilibrium nitric oxide must instead be based on a distribution in time and space of local peak temperature states. It is indicated that local nitric oxide concentrations attain peak temperature equilibrium values, and the possible formation and subsequent quenching of hyper-equilibrium concentrations is ruled out.

1810 APTIC NUMBER 20114

Oberdorfer, P. E.
THE DETERMINATION OF ALDEHYDES IN AUTOMOBILE EXHAUST GAS. SAE (Soc. Automotive Engrs.) Trans., 76(1):763-773, 1968. 14 refs.

A method for the sampling and determination of exhaust aldehydes and ketones is described which consists of absorbing and converting these compounds to the solid 2,4-dinitrophenylhydrazone derivatives. After a known volume of gas has been scrubbed, the composite solid derivatives are isolated and determined gravimetrically. When this method was applied to the exhaust analysis of pre-tuned, late model automobiles, cars with exhaust emission controls produced a level of total aldehydes similar to the group of nonequipped cars (100 to 280 ppm). The level of aldehydes from the equipped cars as a group was lower when the total unburned hydrocarbons were lower, while the level from the cars with no exhaust controls was higher when the total unburned hydrocarbons were lower. Air-fuel ratio was the most important variable to affect aldehyde emissions, as leaner mixtures caused their increase. Regardless of the exhaust emission device, mild accelerations generated the highest level of total aldehydes emitted. the amount of aldehydes emitted from device equipped cars was significantly related to the chemical structure of pure individual hydrocarbon fuels, with the benzene ring contributing the least and branched hydrocarbons the highest levels. (Author summary modified)

1811 APTIC NUMBER 20101

Perez, J. M. and E. W. Landen
EXHAUST EMISSION CHARACTERISTICS OF PRECOMBUSTION CHAMBER ENGINES. SAE (Soc. Automotive Engrs.) Trans., 77(2):1516-1533, 1969. 10 refs. (Paper 680421.)

The differences between diesel engine combustion systems were demonstrated by comparison of precombustion chamber and experimental direct injection engines; emission measurements were made on total hydrocarbons, nitrogen oxides, carbon monoxide, carbon dioxide, and smoke. The mobile hydrocarbon analyzer employed was a modified commercially available gas chromatograph containing a hydrogen flame ionization detector. A sample of exhaust gas was drawn from a probe in the exhaust stack through a heated inlet line and a heated oven compartment by an oil-less vane type pump, and it was split 35:1 by use of suitable tubing in the discharge line from the pump. The smaller portion of the sample flowed to the hydrogen flame detector while the bulk of the gas stream exited through a static head water bubbler that served as a constant pressure line. The precombustion chamber was significantly lower in emissions, but odors from both the precombustion chamber and the direct injection systems were similar when both engines burned the same fuel. The total weight of exhausted hydrocarbons per 1000 gal of fuel measured from a precombustion chamber type engine, as used in highway truck applications, was about 10% of the current automotive standard. Odor intensity was about 20-30% of that from the direct injection engine, based on volume concentration of a sensory reference odor, and the oxides of nitrogen were appreciably lower in the exhaust of precombustion chamber engines.

1812 APTIC NUMBER 20787

Peters, Wolfgang and Dieter Paffrath
INVESTIGATION OF CORRELATIONS BETWEEN FRACTIONATION EFFECTS AND PARTICLE SIZE DISTRIBUTIONS IN FISSION PRODUCT SAMPLES. J. Geophys. Res., 75(15):2991-2998, May 20, 1970. 23 refs.

After the third Chinese nuclear bomb test, radioactive aerosol was collected on fiber filters from the atmosphere at different altitudes. By comparing the measured B(-)-decay curves with the theoretical b(-) decay curves, the fractionation factor of the fresh fission products and the activity of the U237 in the samples were determined. The samples were autoradiographed and the spot-size distribution and background blackening of the autoradiographs were measured. By evaluating the particle sizes (particle activities) from spot sizes and comparing the results of B(-)-decay curve analysis and of the autoradiographs, a relation existed between fractionation degree and particle-size distribution; nuclides originating from volatile precursors were enriched in small particles, and nuclides from refactory precursors were enriched in large particles. Uranium 237 was also enriched in small particles and fractionates like nuclides descending from volatile precursors. (Author abstract)

1813 APTIC NUMBER 20112

Robinson, Elmer and Robert C. Robbins
GASEOUS NITROGEN COMPOUND POLLUTANTS FROM URBAN AND NATURAL

SOURCES. J. Air Pollution Control Assoc., 20(5):303-306, May 1970. 18 refs.

Major aspects of the circulation through the atmospheric environment of a number of gaseous nitrogen pollutants, as well as ammonia and nitrous oxide, have been estimated, including source magnitudes, residual atmospheric concentrations, and scavenging processes. The atmospheric nitrogen cycle is apparently dominated by natural emissions of ammonia, nitric, and nitrous oxide, while pollutant emissions, of NO2 play only a minor role relative to the natural sources. Scavenging mechanisms for removing nitrogen compounds from the atmosphere include surface reactions, the formation of nitrate and ammonium aerosols, and the biological reduction of nitrous oxide. Photochemical processes in the stratosphere are well known in the nitrous oxide cycle, but they appear to be less important than biological processes. (Author abstract modified)

1814 APTIC NUMBER 17885

AIR POLLUTION-THE PROBLEM AND THE RISKS. S.A.E. (Soc. Automot. Engrs.) J., 76(5):47-52, May 1968. 4 refs.

Part 1 of the report of the SAE Panel on Electrically Powered Vehicles is presented. Total U. S. air pollution by source in 1966 (carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides, and particulates) and the amount of individual contaminants by source in 1966 (industry, power plants, motor vehicles, space heating, and refuse disposal) are considered. The effect of air pollution on health is discussed, with special reference to contaminants associated with the automobile. The first three of 16 specific recommendations made by the Panel to the Federal government as a 'Program for Progress' in the control of air pollution are explained. The national goal for air quality should be the achievement of an atmosphere with no significant detectable adverse effect from air pollution on health, welfare, and the quality of life. A research program should be established to determine the effects of air pollution on atmospheric processes. The Department of Health, Education and Welfare should be urged to develop and promptly implement an expanded program to establish quantitative information regarding the effects of air pollution on health and welfare.

1815 APTIC NUMBER 17842

Stahl, Quade R.
PRELIMINARY AIR POLLUTION SURVEY OF HYDROCHLORIC ACID: A LITERATURE REVIEW. Litton Systems, Inc., Silver Spring, Md., Environmental Systems Div., Contract PH 22-68-25, NAPCA Pub. APTD 69-16, 69p., Oct. 1969. 117 refs.
CFSTI: PB 188067

Prolonged exposure to low concentrations of hydrochloric acid can cause erosion of teeth, while severe exposures can result in pulmonary edema and laryngeal spasm. Recent data indicate that hydrochloric acid is also a stronger phytotoxicant than reported in earlier literature. The acid is strongly corrosive to most metals. In the United States, hydrochloric acid is produced as a by-product of the chlorination of organic compounds, processes involving the reaction of common salt with sulfuric acid, and the chlorine-hydrogen synthesis process. However, atmospheric emissions of the acid result from a large number of sources other than its manufacture and use. These include heating or burning of chloride-containing materials in the presence of organic compounds or other hydrogen-containing compounds. The high solubility of hydrogen chloride in water and the low vapor pressures of even 20% hydrochloric acid solution make collection of hydrogen chloride in water an effective and inexpensive method of control. Packed tower absorption systems are rapidly being replaced by cooled absorption systems consisting of either a countercurrent or co-current flow of gas and water. By the use of two or more towers in a series, emissions can be reduced to 0.1 to 0.3% by volume. Other systems effective for the control of hydrochloric acid or hydrogen chloride emissions are the rotary brush scrubber and the ejector venturi scrubber. Collection efficiencies for these systems can reach 99%.

1816 APTIC NUMBER 20134

Sullivan, J. L.
AIR POLLUTION--CAUSES AND CONTROL. Occupational Health Rev. (Ottawa), 20(3-4):9-23, 1968-69.

Pollution due to the burning of liquid and gaseous fuels, and industrial emissions is discussed; methods for measuring solid particles and gases are described, and their prevention or elimination is considered. Gasoline internal combustion engines seldom burn fuel completely, resulting in discharges of carbon monoxide and hydrocarbons, while nitrogen oxides occur as the combination of nitrogen and oxygen in air under the influence of high temperatures inside the cylinders of the engine. These compounds are significant as components of sunlight-induced or photo-chemical pollution, causing eye irritation, and damage to vegetation and materials. Diesel exhausts discharge greater quantities of carbon particulates and odorous materials, partly attributable to aldehydes and other fuel decomposition products, than the emissions of the gasoline engine. Lead, zinc, copper and nickel smelting release large quantities of sulfur dioxide, while the manufacture of iron and steel causes visible fine particulate plumes. Gaseous and solid fluoride compounds are evolved by the electrolysis of aluminum oxide, and paper manufacturing results in the escape of odorous sulfide and mercaptan compounds. Soot or dust-fall can be collected very simply in open-top gauges, separated from the water by filtration, then dried and weighed; dust can be measured by means of a device similar to a vacuum cleaner, in which a sample of air is drawn through a filter, composed usually of paper or fibre-glass, and the quantity of dust is determined by subtracting the previously-determined weight of the filter. Gases are often measured continuously by absorption of infrared or ultra violet electromagnetic rays. Legislation for the reduction of emissions has two main objectives: to establish standards and to enforce them. It is preferable to employ methods which do not create pollution, but filters are mentioned for the many processes which cannot avoid generating dust. Pollution control has been a provincial responsibility in Canada, and specific acts of legislation are cited.

1817 APTIC NUMBER 17826

Todd, James A., Jr.

A LOOK AT AN-FO'S INVISIBLE FUMES. Mining Engineering, vol. 15:43-46, April 1963. 3 refs.

During 1959-1960 Du Pont cooperated with the U. S. Bureau of Mines to study the toxic fumes produced by prilled ammonium nitrate-No. 2 fuel oil mixtures. The conclusions from this work were that oxygen balanced AN-FO, when thoroughly mixed, well primed and well confined in dry holes, produces no greater amounts of toxic fumes than conventional dynamites rated Class I by the Institute of Makers of Explosives. The study also showed that any deviation from these guides tends to increase significantly the quantity of toxic fumes produced. A review of the fume study was conducted in 1962 to see if the original conclusions had been confirmed by the extensive use of AN-FO in underground mines over the intervening period. No disagreement was found with the earlier study. The concern at present is that AN-FO does not retain its 'as manufactured' oxygen balance. Due to loss or migration of oil, AN-FO is not properly oxygen balanced at the time of use. The possible fume hazards can be controlled if they are recognized and reduced by: (1) ventilating to the extent that CO and NO2 can be reduced to acceptable limits; (2) timing work procedures to enable fume dilution before men return to the working areas; (3) adopting procedures that are known to minimize toxic fume production; and (4) using a mixture for pneumatic loading which the explosive industry stamps with an Institute of Makers of Explosives' Class I fume rating.

1818 APTIC NUMBER 18202

MEASUREMENT OF AUTOMOBILE EXHAUST GASES IN TUNNELS. VDI (Ver. Deut. Ingr.) Z. (Duesseldorf), 110(30):1316, Oct. 1968.

A traffic jam was simulated in the 550 m-long tunnel in Hamburg with 20 Diesel vehicles (refuse collection trucks) and 40 VW passenger cars. The engines of the automobiles aligned bumper to bumper were operating in the idling phase. The experiments lasted 30 minutes each time. The air speed in the tunnel at switched-off ventilators was about 1 m/sec. Evaluation of the measurements showed that while running Diesel engines the CO content of the tunnel air rose by only 2 to 18 ppm; however, while running Otto engines, CO content rose by 400 ppm. The maximum hydrocarbon concentrations measured with Diesel engines centered around 0.03 g/cu m and by 0.15 g/cu m with Otto engines. The nitrogen gas concentrations measured while running Diesel engines amounted to a maximum of 12 ppm NO2. Even at concentrations of 8 ppm NO2, the drivers complained about eye irritation. Limitation to 5 ppm is recommended.

1819 APTIC NUMBER 20067

Velazquez, Julio Cueva
FLORA AND ALLERGENIC POLLENS IN THE REPUBLIC OF MEXICO. (Flora y polenes alergenicos en la Republica Mexicana). Text in Spanish. Alergia (Mexico), 17(3):99-110, 1970. 35 refs.

A survey is made of the literature and findings of the study of allergenic flora in the Republic of Mexico, first begun in 1933 in the Valle de Mexico. The report includes the studies in 50 Mexican cities. Summarized are classifications of the allergenic flora, clinical studies of symptoms caused by pollens, treatments used for sufferers, and methods of study in the various parts of Mexico. Next to the USA, Mexico is possibly one of the best informed countries with respect to its knowledge of allergenic flora. Several criteria determine whether or not a particular pollen is an important problem: the pollen must contain an allergen, must be susceptible to wind transportation, must be produced in large quantities, must be sufficiently lightweight to travel long distances, and must be produced by a plant that has a sufficient distribution in the country.

1820 APTIC NUMBER 20124

Wade, D. T.
FACTORS INFLUENCING VEHICLE EVAPORATIVE EMISSIONS. SAE (Soc. Automotive Engrs.) Trans., 76(2):811-823, 1968. 6 refs. (Paper 670126.)

The basic factors influencing carburetor and fuel tank evaporation losses were explored in road and dynamometer tests of a 1863 model with a V-8 engine and 2-bbl carburetor. Test fuels covered a variety of Reid vapor pressures. In addition to the vehicle tests, the behavior of fuel in the carburetor during a short soak was simulated by a one plate equilibrium distillation technique. Vehicle factors affecting carburetor hot soak losses were maximum bowl temperature and bowl volume (initial volume and after-supply). The fuel factor was distillation. Thus, changes in carburetor emissions due to changes in fuel can be evaluated by comparing the percent distilled at the maximum bowl temperature of the car in question. In the context, the Reid vapor pressure is not the controlling factor. Fuel tank losses were influenced by tank temperature, vapor volume, tank pressure, rate of equilibration of liquid and vapor, and vapor pressure of fuel. The above factors were combined in a mathematical model to predict the magnitude and composition of evaporative losses. Although the correlation between predicted losses and losses measured during dynamometer runs is poor, the model satisfactorily describes losses during road runs.

1821 APTIC NUMBER 20240

Weissbach, Helmut
COLOGNE SPRING FAIR 1966: ALL-GAS APPLIANCES ON A WIDE FRONT. (Koelner Fruehjahrsmesse 1966: Allgasgeraete auf breiter Front). Text in German. Gas Wasserfach (Munich), 107(21):586-592, May 27, 1966.

A detailed review of new domestic gas appliances and accessories exhibited at the Cologne Spring Fair in 1966 includes the following: kitchen ranges, baking ovens, washing machines, hot-water heaters and domestic heating furnaces. Devices for ignition of gas pilot lights and electric high-tension sparks are described. Control methods for the domestic heaters include: manual control; semi-automatic control with, for example, a fluid thermostat and

without electric current; semi-automatic control with a thermo-electric thermostat; semi-automatic with remote control by a 220-volt thermostat; and fully automatic. Most appliances were equipped with 'all-gas burners' providing the possibility of operating the appliance with city gas, or natural gas, or 'liquid gas'.

1822 APTIC NUMBER 20128

Wyczalek, Floyd A., Daniel L. Frank, and Gene E. Smith
A VEHICLE FUEL CELL SYSTEM. SAE (Soc. Automotive Engrs.) Trans, 76(2):1008-1028, 1968. 3 refs. (Paper 670181.)

A hydrogen-oxygen fuel cell power plant was built to investigate the scale-up and operating problems of a system large enough to power a small van. In its final form, the power plant consists of 32 modules, weighs 3360 lbs, and has a volume of 76 cu ft. The specific weight of the complete power plant is about 21 lb/kW and the specific volume is about 0.49 cu ft/kW. About one-half the weight is in the auxiliaries. A circulating electrolyte system enables the unit to achieve a peak power of 1860 kW for short periods by removing rejected heat directly at the electrodes. The performance of the power plant was evaluated in van simulator tests and in chassis dynamometer tests of a van with the unit installed. Test results are graphically illustrated and discussed. While the efficiency of the fuel cell system exceeds 50% at rated power, load auxiliary power and leakage losses reduce efficiency at light load. The parasitic power exceeds 5 kW. This can be reduced with further development, but not eliminated. Further more, auxiliary motor current distribution exposes some modules to a load exceeding 30% of rated current. This problem can be solved by the use of higher voltage auxiliary motors and relocation of auxiliary power taps, but the fuel problem will remain. Liquid or gaseous hydrogen and oxygen are not practical for an automotive power plant. Future research and development in fuel cell technology should be based on a hydrocarbon fuel.

1823 APTIC NUMBER 18163

Zawadska, E.
NOXIOUS SUBSTANCES IN THE ATMOSPHERE OF MANGANESE-ALLOY PLANTS. (Substancje szkodliwe w atmosferze huty stopow manganu.) Text in Polish. Wiadomosci Hutnicze, 25 (3):96-98, March 1969. 2 refs.

Dust samples were obtained for various locations in a plant producing ferromanganese, silicon-manganese, and ferrosilicon. The material was collected over 4- to 5- hour periods, on Whatman No. 41 filter paper. The samples were burned, and dust-sizes, incineration losses, manganese, iron, and silica content were determined. At the smelters and tapping-hole locations, 90 to 100% of the dust measured less than 0.3 microns, and contained little iron but considerable manganese. Maximum dust content was recorded at a height of 3.0 meters near the silicon-manganese furnace, and amounted to 46.8 mg/cu m while the manganese content at the same location was 16.71 mg/cu m maximum. Comparisons with established norms indicated that actual exposure to dust in this plant exceeded the maximum allowable by 2 to 5 times at smelting and tapping locations, 10 to 13 times in the storage and supply system, and by 5 times at the cleaning locations.

# CONTROL METHODS

1824 APTIC NUMBER 18144

DUST CONTROL: SOLVING THE AIR POLLUTION PROBLEM. Agr. Chem., 24(6):15-17, June 1969. 7 refs.

When an air quality control region has been designated, the state involved must set standards for that region. States are beginning to take action against factories suspected of contributing to air pollution. Suspected violations in Montana led to an abatement conference at which the emission of fluorides by phosphate plants was investigated following complaints from local residents concerning nose, throat, and respiratory irritation and property damage to metal and glass. It was noted that fluoride emissions are an adjunct to the process used but that they could be reduced with a high degree of efficiency. Land configurations and prevailing winds added to the problem at one plant. The TVA has developed methods for detecting, measuring, and recovering process materials. In one system, dust is recovered from dry cyclones and slurried in dilute process liquor for return to the process. Other suggested systems recovered carryover from a nitric phosphate preneutralizer and dust in a granular fertilizer plant.

1825 APTIC NUMBER 20816

Allan, Adrian R., Jr.
FILTER BANK ASSEMBLY. (Flanders Filters Inc., Riverhead, N. Y.) U. S. Pat. 3,486,311. 5p., Dec. 30, 1969. 15 refs. (Appl. Dec. 22, 1967, 7 claims).

A filter bank system for supplying virtually dust-free and bacteria-free air to critical production or laboratory areas is described. A supporting latticework of U-shaped channels have their open sides directed upward. A number of filter modules are positioned on the latticework to cover its open areas. Each filter module comprises a filter pack and a surrounding frame. The frame has a continuous vertically disposed edge resting in the upper side of the channel. The channels have a high consistency liquid in them to block the passage of air.

1826 APTIC NUMBER 20147

ALUMINIUM FOR SUB-ZERO METHANE. Aluminium Courier, no. 46:19-22, 1959.

Aluminum, used for many years for low temperature equipment, was chosen for the very large welded storage tanks required in the British importation of liquid methane, which must be maintained at a maximum temperature of -260 F. An alloy containing about 5% magnesium was selected for the tanks, while a different alloy was used for the piping to convey the cold liquid from the tankers to the on-shore storage facilities. The construction, insulation, and testing are briefly described. Fabrication of the storage tanks was entirely by inert-gas metal-arc welding. Radiographic, hydraulic, and halogen leak tests were conducted to insure against any possible leakages.

1827 APTIC NUMBER 17929

Anderson, P. J. and A. R. Khan
STORAGE CONTAINERS FOR LIQUEFIED NATURAL GAS. Civil Eng. (N. Y.), vol.35:65-67, Aug. 1965.

The advantage of storing natural gas as a liquid is that each cubic foot, when evaporated, yields 630 SCF (standard cu ft of gas, measured at 60 F and 30 in. of mercury). Three types of containers acceptable to industry are above ground double-wall metal tanks, cryogenic in-ground storage facilities, and prestressed concrete tanks. Evaporation rates for tanks of double-wall construction can be varied from 0.05 to 0.10% per day by the thickness of the insulation used. In-ground tanks are constructed in soil, rock, or both. Freeze pipes through which suitable refrigerant is circulated are installed, and extend into the underlying rock or soil, so that a ring of frozen ground is formed. No insulation is used to line the walls of the pit, but the base and the roof are insulated. The ice in the frozen soil also acts as an insulant. Because of the insulating qualities of the ice-soil system, the initial evaporation rates are higher than for metal tanks. However, the rate of evaporation decreases with time; at the end of three years, it can vary between 0.15 and 0.20% per day. The walls of underground prestressed concrete tanks are wrapped with prestressing wires. The insulating effect of the soil contributes to reducing boiloff rates which, for large tanks, vary from 0.05 to 0.1% per day. Another type of underground storage system for large-volume storage of liquefied natural gas is under development. It involves storage in mined room-and-pillar type caverns.

1828 APTIC NUMBER 20822

Aoki, Toyohiko
APPARATUS FOR PURIFYING POLLUTED GAS. (Naigaikogyo Kabushiki Kaisha, Tokyo (Japan)) U. S. Pat. 3,479,799. 9p., Nov. 25, 1969. 9 refs. (Appl. March 10, 1967, 2 claims).

A device for purifying polluted gases from factory equipment, heaters or burners, and internal and external combustion engines is described. The polluted gas is sent to a perforated rotary drum where it is contacted with a liquid. The gas and liquid are passed through the perforations of the drum and then dispersed by centrifugal force produced by the high speed rotation of the drum. The gas is then mixed with the liquid, and the fine particles and harmful elements in the gas are positively transferred into the liquid. The purified gas and the liquid are separated in a cyclone. The liquid is sent to a storage area where the particulate matter is removed, and is then conveyed back to the contact mechanism.

1829 APTIC NUMBER 20129

Barry, Charles B.
HERE'S WHAT'S BEING DONE TO COMBAT SULFUR-OXIDE AIR POLLUTION. Oil Gas. J., 68(9):63-67, May 11, 1970. 4 refs. (Presented at

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the NGPA Annual Convention, Denver, Colo., 1970.)

Sulfur oxides control is discussed with reference to emissions from oil refineries and gas-processing plants. Three choices are available to the industry to control SO2 emissions from petroleum products: refining more low-sulfur crude; using refining processes, such as hydrodesulfurization, to reduce the amount of sulfur in the fuel; and developing methods of removing sulfur dioxide from flue gas produced by process operations or power plants. Recent pilot-plant studies indicate that it might be more economical for a large user to buy cheaper, high-sulfur fuel and remove the sulfur from the stack. Sulfur recovery operations in the U. S. alone produced 1.4 million long tons in 1969, which were profitably used in the economy. In special situations, the industry has recovered ethyl mercaptan and liquid hydrogen sulfide. The Claus sulfur operation is a primary tool for reducing SO2 emissions from sour-gas operations. Well-designed plants can recover from 75 to 97% of the sulfur as hydrogen sulfide. Lined steel stacks make it possible to reduce tail gas to acceptable 24-hr average concentrations. Other processes which produce sulfur and which could replace the Claus process use a combination of absorption in aqueous solutions and air oxidation. Additional processes for treating tail gas are reviewed. The economic advantage of those eliminating incineration is noted.

1830 APTIC NUMBER 17976

Beck, Horst
MODERN DUST COLLECTING PLANTS FOR FOUNDRIES. (Neuzeitliche Entstaubungsanlagen fuer Giessereien). Text in German. Ind. Anz., 90(99):11-14, Dec. 10, 1968.

Central dust collection systems are usually installed in foundries. Exhaust fans are installed at each individual dust source. Dynamic wet collectors have been successfully used in such plants wherein fine dust particles are precipitated by bringing them in close contact with water through centrifugal force in an S-shaped patented collector. High power or multi-cyclones are used for cleaning the waste gases from cupola furnaces, residual dust concentrations of about 1.0 to 1.5 kg/ton of iron are achieved. Wet collectors have frequently been used for this purpose, but the extensive protective measures against corrosion posed too many problems. Residual dust concentrations of less than 10 mg/standard cu m were achieved with cloth filters at cold-blast furnaces, and of less than 20 mg/standard cu m at hot-blast furnaces. Siliconized glass filters were used as the filter medium; they can withstand temperatures of 300 C over long terms and for a short time, even 400 C. The resistance to acid and bases is excellent. Vapors are likewise drawn off at the point of origin and cleaned from air pollutants in an electrostatic precipitator.

1831 APTIC NUMBER 20226

Behrendt, Anton
GAS CLEANING IN RELATION TO OXYGEN PRE-REFINING AND THE ROTOR PROCESS AT OBERHAUSEN. In: Air and Water Pollution in the Iron and Steel Industry. London, Iron and Steel Inst., 1968, p. 90-96. 2 refs.

The oxygen lancing and Rotor processes in use at Oberhausen, Germany, and the experimental and final plants used to clean the gases given off are described. The costs of running a bag filter are given; these are exceeded by the value of the iron content of the dust recovered. The differences between the dusts from the processes are described and the reasons for them are advanced. The different methods available for the removal of the troublesome brown color from the gases of the pre-refining in the ladle and in working the Rotor are shown. In contrast to the amount of gas which results from blowing in the converter with or without oxygen enrichment of the blast, the quantities from both the other processes on the production scale can be kept within controlled limits. Where high gas purity is required the Elektro-filter or the Pease-Anthony apparatus could be used. The very high outlet temperature of the Rotor calls for special protection for the gas ducts. On the basis of the observations, the dust formed in the Rotor is estimated at about 15 kg/ton of pig iron. This value is appreciably higher than for pre-refining in the ladle, which amounts to only 4.46 kg/ton. For cooling the gas ducts, 200-240 cu. m. of water/hr are necessary.

1832 APTIC NUMBER 18149

Bell, W. J. and A. W. Overington
DUST RECOVERY IN THE KINLEITH BOILERHOUSE. Appita, 22(5):140-145, March 1969.

The equipment used to collect dust and ash from flue gases discharged by the five primary boilers firing oil, woodwaste, and coal consists of three separate dust recovery units. The first unit is rated at 110 air dried tons of pulp per day and is equipped with an ash hopper between the boiler and cyclone and an electrostatic precipitator after the cyclone for collection of saltcake and other dust from the flue gases. The precipitator has two fields with square wire emitters and plate collectors with 60 kv applied between them. Collection efficiency is between 75 and 95%. The second recovery unit is rated at 110 air-dried tons of pulp per day and is equipped with an ash hopper, a venturi scrubber, and a black liquor evaporator after the boiler. The venturi scrubber handles 60,000 cu ft/min of flue gases at 700 F. Differential pressure over the venturi is between 28 and 33 in H20 gauge, depending on black liquor viscosity and operating rates. Saltcake collection efficiency is 80%. Number three unit is rated at 250 air dried tons of pulp per day. It has a cyclone evaporator and an electrostatic precipitator after an economizer. Black liquor at 45% solids is sprayed into the hot flue gas at 630 C from the economizer just before the cyclone. The 70,000 kv, 500 ma, two stage precipitator is designed to handle gases at 105,000 cu ft/min and between 230 and 375 F. Collection efficiency is 99%.

1833 APTIC NUMBER 18153

Bernicchi, Robert V.
ODOR CONTROL AT TREATMENT PLANT WITHOUT MASKING. Western City Mag., 44(4):34-35, April 1968.

Abatement of odor from the sewage treatment plant of North San Mateo County is reviewed. Treatment facility odor problems could not be solved by chemical additions to sewage, but the gases emanating had to be treated. The sources of odor were: the bar screen chamber, the sludge thickener, the sedimentation tank, the grit chamber, and the gas blow off on the primary digester. Odor from the sedimentation tank was eliminated by sealing off the tank with a concrete slab. Instead of masking the odors from the other sources, oxidation was utilized. The chemical used was Odorex, a potassium manganate compound, the chemical being automatically mixed with water and atomized over the affected area. Odors emitted by the gas blow off of the primary digester were controlled by a special scrubber unit utilizing Cataban, a compound not as effective as Odorex but capable of being regenerated and reused. Aside from odors at the treatment facility, the district had experienced problems with an inverted syphon constructed to temporarily transport sewage from a distant subdivision. The syphon emitted sulfides at a rate as high as 400 ppm. The syphon problem was solved by the addition of ferrous sulfate to the sewage being discharged into the syphon. The chemical was automatically added at the rate of 250 lbs/day.

1834 APTIC NUMBER 18150

Bethune, W. J. and Lance J. Foord
ONE PLANT'S ANSWER TO AIR POLLUTION CONTROL. Prod. Finishing, p. 66-69, July 1969.

Magnetic wire for motors, generators, transformers and other electrical devices is produced by General Electric Canada, Ltd. GE applies five to seven different coatings to the wire for insulation and protective purposes. The enamel file is cured by baking in electrically heated, vertical ovens. Fumes emanating from these ovens contain solvent vapors which may cause air pollution. To combat this problem, two catalytic fume abaters are employed which oxidize the pollutants through low-temperature combustion. As catalytic combustion occurs in a honey-comb cartridge coated with a mixture of platinum and aluminum, the temperature of the vapor stream rises to about 780 F. Thermocouples in the catalytic chamber and afterburner area automatically control the preheating gas valves. The units are normally controlled automatically, but there are manual controls such as signal alarm systems which alert employees when there is a malfunction. There are several advantages to using this catalytic oxidation process, particularly in the area of heat that is generated. The heat from the exothermic reactions in the catalytic chamber may be used to heat a plant, generate power, or be fed back into the process.

1835 APTIC NUMBER 17913

Bintzer, W. W.
DESIGN AND OPERATION OF A FUME AND DUST COLLECTION SYSTEM FOR TWO 100-TON ELECTRIC FURNACES. Iron Steel Engr., 41(2):115-123, Feb. 1964.

Roof fans are not adequate to remove the dust and fumes generated by an electric furnace. Fumes and dust are not only a safety hazard, but also present poor working conditions. The collection system at a steel plant and some of the unusual modifications to make it work are discussed. The sytem is schematically presented. The material collected has a dry density of 40 to 50 lb/cu ft. It flows like water; however, it can become sufficiently cohesive so as not to flow on a 45-degree slope. About 15 lb of material/ton of steel produced or approximately 10 to 12 cu yd/day are collected. Qualitative spectrograph analysis of particulate as collected is tabulated. A major problem has been extreme temperature in the ducts and the resulting by-passing of the collector. The system was designed to operate normally under 250 F at the bag house, but temperatures of 600 F have been recorded. The high duct temperature that causes this system to by-pass is produced at the end of the water-cooled elbow. This temperature is the result of the heat evolved by the combustion of the various gases produced in the furnace. Even though the system will collect over 95% of all the particulate generated in the furnace if reasonable charging practice and proper furnace operating procedures are followed, the problem of electric furnace smoke and fume formation, collection, and disposal is still far from completely satisfactory. However, this system as installed and properly operated will satisfactorily meet the requirements and intent of any of the present existing codes on air pollution.

1836 APTIC NUMBER 20244

Boenecke, Herbert and Michael Hansen
FLOW TESTS WITH MODELS IN THE DEVELOPMENT OF SUCTION OFFTAKES FOR CONVERTER WASTE GASES. (Stroemungsmodellversuche bei der Entwicklung von Absaugeanlagen fuer Konverterabgase). Text in German. Stahl Eisen, 87(16):951-958, Aug. 10, 1967. 15 refs.

Experiments were performed on a model to aid the planning of an exhaust system drawing off waste gases from a converter. The influence of the geometric similarity and of the Re-number, used to characterize the mechanical similarity, on the simulation of the actual flow in the large-scale system is discussed. Two border cases are used: the flow around a disk which is independent of Re, and the frictional flow greatly influenced by Re. The free jet flow is also briefly explained. Depending on the prevalence of the one or the other type of flow, a more or less exact approximation of the Re-number to the large-scale system is permissible. The gas flow at the entrance of the exhaust system was studied on the model for new and used converters and with various intake openings. The flow conduction in the pipes behind the exhaust intake was likewise studied to avoid explosions. Finally, the flow at the transit to the preliminary scrubber was closely watched. Despite the small-scale of the model (1:20) and the much higher viscosity of the hot waste gas as compared to cold air, a Re-number of one fourth of that of the large-scale system was achieved. Illustrations of the waste gas flow at the outlet of the converter and the exhaust intake are given. The flow test studies greatly helped the construction of an efficient exhaust system. The large-scale system has been operating satisfactorily for quite some time now.

1837 APTIC NUMBER 20073

Bouilliot, Robert
EXPERIMENTAL STUDY OF THE EFFECTS OF RECYCLING FUMES ACROSS A

LAYER OF ANTHRACITE BURNED OVER A FIXED GRATE. (Etude experimentale des effets du recyclage des fumees a travers une couche de grains d'anthracite en combustion sur grille fixe). Text in French. Rev. Gen. Thermique (Paris), no. 98:139-155, Feb. 1970. 3 refs. (Presented at the journees de la combustion 'Verbrennung und Feuersengen', Karlsruhe, Germany Sept. 18-19, 1969.)

The effects of recycling were measured in an experimental hearth consisting of a crucible with an inner diameter of 200 mm fitted with a grate of 6 mm cylindrical steel bars spaced 6 mm apart, on which the anthracite was placed. The effects of the recycling consist of an important change in the temperature profile in the layer, an important decrease in the carbon monoxide content of the fumes and a slight increase in the carbon dioxide content, a slower extinction of the layer, a noticeable decrease in the rate of combustion-gasification, especially during the extinction period, and a greater amount of unburned residue. The industrial significance of the findings might be summarized as follows: the process produces a temperature profile in the layer more favorable to a longer period of service and construction with less costly materials; decreased temperatures in the bed and the almost complete absence of CO, which raises the melting point of silicates, inhibits the fusion of the minerals, and reduces the total effects in the amount of clinker, which is detrimental to the material of which the hearth is made; and reduces the problem of the release of CO into the atmosphere.

1838 APTIC NUMBER 20216

Braginets, N. G., and A. Ye. Prikhozhenko
REDUCING DUST FORMATION IN THE OXYGEN-CONVERTER PROCESS. (Snizhenie pyleobrazovaniya pri kislorodno-konverternom protsesse). Text in Russian. Metallurg., 12(9):16-19, Sept. 1967.

Dust formation was analyzed in converters with single-and multiple-nozzle tuyeres. Data show the effect of oxygen consumption rate on dust content and on molten metal yield. The average composition of the dust was as follows (%): 67.10 Fe, 0.95 Mg, 11.8 CaO, 13.3 FeO, 0.125 P2O5, trace Al2O3, 3.80 MnO, and 2.925 SiO2. Particle size distribution data is also given. Conversion of multiple-nozzle tuyeres reduced the dust content of exhaust gases to 100-70 mg/cu m with water flow rate in the scrubber at 230-260 cu m/hr.

1839 APTIC NUMBER 20013

Bretsznajder, St.
UTILIZATION OF SO2 FROM DILUTED INDUSTRIAL WASTE GASES. (Wykorzystanie dwutlenku siarki zawartego w rozcienczonych gazach odlotowych). Text in Polish. Przemysl Chem., 31(8):276-284, 1952. 28 refs.

Several methods of sulfur dioxide regeneration from combustion gases of power-plants, waste gases of glass work, etc., which contain less than 3% of SO2 are received. Absorption of SO2 in Ca(OH)2 results in 98% removal of SO2; the products of the reaction (calcium sulfate and sulfite), however, cannot be further utilized. Sulfur dioxide absorption in MgO suspension in water results in the water insoluble MgSO3 being thermally dissociated and MgO returned into process; 98% SO2 is absorbed. The problem is corrosive and erosive activity of absorbing suspension is discussed. The absorption of SO2 in Na2CO3; absorption in water solution of ammonia, suitable for gases of SO2 concentration .5 - 3 %; and the catalytic method, the product of which is diluted H2SO4 and in which Fe(3+), Ca(2+), and Mn(2+) ions serve as catalysts for oxidation of H2SO3 to H2SO4 are also presented. Modification of the method used in the USSR yields 20 % H2SO4. Prior to any treatment, the combustion and waste gases have to be de-dusted and cooled. The utilization of SO2 regenerated from diluted industrial gases is discussed. The different methods of SO2 removal from gases are critically evaluated and compared; expenses for reagents and apparatuses, utilization of the reaction products, and effectiveness in purification on the gases from SO2 are taken into account.

1840 APTIC NUMBER 17948

REMOVAL OF SULFUR DIOXIDE FROM FLUE GASES. Brit. Chem. Eng., vol. 1:99-100, June 1956.

Pilot plant experiences with three flue-gas scrubbing processes are reported. Each process saturates flue gases with water, using magnesium oxide, magnesium hydroxide, or ammonia to increase the absorptive capacity of water. In the first process, magnesium sulfite is precipitated from a suspension of magnesium oxide in water. Sulfur dioxide is evolved and the magnesium oxide is recycled. This process requires large quantities of fuel for drying and calcining the sulfite. In the magnesium hydroxide process, magnesium sulfate is treated with ammonia to form saleable ammonium sulfate. A process using an aqueous solution of ammonia has the advantage that the waste effluent is a valuable product and that unit costs decrease as the capacity of the scrubbing plant increases. The process uses a scrubbing liquor of ammonium sulfate, sulfite bisulfite, and thiosulfate obtained from a gas works. Ash and sulfur dioxide are removed in one operation and gas liquor is added at a rate corresponding to that of the absorption of sulfur oxides. Before scrubbing, dust and impurities are removed from the flue gas by filtration. The ammonium sulfate produced by heating the ammoniacal solution in a autoclave passes through conventional crystallization stages. This process appears to offer the greatest economic advantages.

1841 APTIC NUMBER 20618

Brown, Robert Glenn, Burton Nathaniel Derick, Jon Ovitt Stanley, and Joan Mauldin Watkins, Jr.
ELECTROSTATIC FILTER UNIT WITH HIGH STABLE CHARGE AND ITS MANUFACTURE. (Du Pont de Nemours (E. I.) and Co., Wilmington, Del.) U. S. Pat. 3,487,610. 14p., Jan. 6, 1970. 19 refs. (Appl. March 26, 1965, 19 claims).

A high efficiency gas filter for separating charged and uncharged fine particles is described. The filter consists of a laminated structure made up of a number of spaced sheet-like portions of polymeric films. The films may be formed from one or more sheets which are maintained in an equidistant spacing by interleaved sheets of glass fibers. A gaseous stream is passed between the

sheets of the film. The charged and uncharged particles are removed by the action of electrical fields existing between electrostatic charges of opposite polarity. The positive and negative charges are maintained on the opposing surfaces of the films, and are high in density, very stable, and can be kept at a high effective level for long periods of time.

1842 APTIC NUMBER 20798

Butler, T. J. and I. J. Kutny
A NEW APPROACH FOR CUPOLA EMISSION CONTROL. Mod. Castings, 57(6):55-56, June 1970. 8 refs.

Although conventional bag filters are one of the most effective collection methods for cupola dischage, the best materials available can withstand only 500 F while cupola discharge can reach 2000 F. It is proposed to cool the gases by raining a torrent of sand down a stack. Hot gases issuing from the cupola pass upward in a counter current through the torrent of sand particles, which quickly absorb heat due to their large total surface area. The gas emerges from the heat exchange stack at reduced temperature and volume. The heated sand is then cooled using the same process in reverse, heated sand being rained in a counter flow of cooling air. The sand is then recycled and the process repeated.

1843 APTIC NUMBER 20821

Caplan, Knowlton J.
METHOD AND APPARATUS FOR FILTERING A GASEOUS MEDIUM. (Hart-Carter Co., Chicago, Ill.) U. S. Pat. 3,487,609. 10p., Jan. 6, 1970. 20 refs. (Appl. Feb. 29, 1968, 4 claims).

A method for cleaning any gas containing suspended solid particles susceptible to mechanical filtering is described. The gas is passed through one or more bag filters in succession or in parallel. A reverse flow of cleaning gas is intermittently passed through the filter at a pressure sufficient to distend it and to wash out any trapped dust particles. Simultaneously, a shock wave of supersonic velocity is transmitted from end to end of the filter bag. The shock wave is not the primary means for cleaning the filter, although it may remove some caked filter dust; it has been found to increase the efficiency of the reverse flow filter cleaning step by 40% or more.

1844 APTIC NUMBER 20018

SIX YEARS OF SOVIET RESEARCH ON METHANE LIQUEFACTION, STORAGE. Chem. Age India, vol. 85:177, Jan. 28, 1961.

Since 1954, a Moscow plant has been liquefying natural gas, storing liquid methane in bulk, and regasifying the liquid for transmission through trunk pipelines to gas consumers during peak load periods. Purification of the gas follows conventional lines. The acidic gases are removed in an absorption column with a solution comprising 20% monoethanolamine, 75% diethylene glycol, and 5% water. The regenerated solution is recycled by an electrically driven plunger pump. The product, containing 0.005 to 0.008% carbon dioxide and a trace of hydrogen sulfide, is dried with activated alumina to a dew point of about 40 C before admission to the compressors and liquefaction unit. They layout and operation of the plant follow an American design with one exception: butane and propane are removed from the compressed natural gas early in the liquefaction cycle. Between the methane condensors is a condensation column that serves to separate heavy hydrocarbons from the gas. At full capacity, the plant produces an estimated 70 tons/day of liquid natural gas. A system now exists for the regeneration of the 'cold' available when the liquid methane is registered. This requires the use of an intermediate cold-exchanger and a mixture of hydrocarbons. As the liquid natural gas evaporates, the hydrocarbon mixture is cooled and stored in a thermally insulated container. The 'cold' so recovered is used in the liquefaction process to reduce power consumption requirements.

1845 APTIC NUMBER 20797

MOVES REVOLVING AROUND RESIDUAL DESULFURIZATION PLANTS. Chem. Economy Eng. Rev., 2(5):19-21, May 1970.

Development of residual desulfurization plants in Japan is prompted by the country's energy structure which is increasingly dependent on heavy oils with an average 1.8% sulfur content. However, natural gas is not available as a source of hydrogen for hydrodesulfurization, so hydrogen is obtained by the steam cracking of naphtha or liquefied petroleum gas. As the hydrogen manufacturing cost is relatively high, 11 of the 14 hydrodesulfurization plants in existence employ indirect processes and perform desulfurization for the sole purpose of blending topped crude. The adoption of direct processes, with their enormous consumption of hydrogen, will depend on reducing hydrogen costs. To solve the air pollution problem, refiners are also reconsidering plant location, seeking new sites and studying the advantages of sea berths and the central terminal system. Seaborne refineries have been proposed.

1846 APTIC NUMBER 20800

BASIC TECHNOLOGY. Chem. Eng. Deskbook, 77(9):165-172, April 27, 1970.

The value of source emission data for evaluating and designing pollution control systems is discussed and the operating principles of a variety of control devices are reviewed. The equipment covers dry mechanical collectors, fabric collectors, low- and high-energy wet scrubbers, plate and pipe electrostatic precipitators, and tall chimneys. Factors affecting the efficiency of the devices are noted as are approximate costs.

1847 APTIC NUMBER 15583

Chertkov, B. A.
AMMONIUM BISULFITE AS A SOURCE OF 100%-SO2 PRODUCTION. Khim. Prom. (Moscow), no. 1:44-?, 1964. 10 refs. Translated from Russian by

William C. Hunn, Tennessee Valley Authority and Wilson Dam, Ala., 12p., Feb. 13, 1968.
CFSTI: PB-178104T

The physical and chemical bases of the process of producing 100% sulfur dioxide from steam-treated ammonium bisulfite solutions are examined. Separation of SO2 from the solutions takes place as a result of an equilibrium hydrolytic reaction, the rate of which increases with temperature. Data are presented to show the influence of temperature on the hydrolysis process. In a given temperature interval, the ammonium bisulfite hydrolysis constant increases with an increase in temperature by a factor of 625. Similarly, temperature strongly influences the dissociation constants of sulfurous acid, ammonia, and water. In the 25-100 C interval, the water dissociation constants increases 74-fold, while the sulfurous acid and ammonia constants decrease 4- and 1.75-fold. The maximum possible capacity of process solution in the cyclic process of absorption and stripping of SO2 is determined by variations in SO2 values in saturated and unsaturated solutions. The maximum SO2 separation from concentrated ammonium bisulfite solutions can be 140 kg SO2 per cu m of solution; the theoretical steam consumption required specifically for stripping will be equal to one ton per ton SO2.

1848 APTIC NUMBER 15585

Chertkov, B. A., B. T. Vasil'ev, T. G. Repenkova, R. I. Boguslavskaya, and N. S. Dobromyslova
PRODUCTION OF 100% SO2 FOR SODIUM HYDROSULFITE MANUFACTURING. Khim. Prom. (Moscow), no. 1:49-52, 1964. 4 refs. Translated from Russian by William C. Hunn, Tennessee Valley Authority and Wilson Dam, Ala., 7p., Feb. 2, 1968.
CFSTI: PB 178105T

A process for producing 100% SO2 uses ammonium bisulfite in the capacity of sulfur. Preheated bisulfite solution is introduced into a stripping column packed with Raschig rings and contacted with steam to effect partial hydrolysis of the solution. Undissociated sulfurous acid forms from which SO2 is evolved by stripping with steam. The spent solution is cooled and then transferred to the contact plant for resaturation. The basic process parameters of the installation are tabulated. A comparison of the process parameters and economic indicators of the method described and the sero-oleum method shows that the ammonium bisulfite method is 28% less expensive per one ton of 100% SO2 and requires three times less power consumption.

1849 APTIC NUMBER 20187

Cosby, W. T.
THE SELECTION OF GAS CLEANING PLANT. Filtration Separation (Purley), 1966:389-395, Sept./Oct. 1966.

The factors affecting the choice of a collector for removing liquid or solid particulate matter from gaseous streams are reviewed. The most important of these are particle size range, pressure drop, acceptable state of particulate matter, degree of cleaning to be expected, maximum acceptable temperature, condition of effluent (wet or dry), dew point sensitivity, and effect of particle density. These variables are tabulated for possible industrial applications and the resulting preferred type of collector is indicated. Particular applications which are discussed include tar fog in manufactured gas, iron oxide fume from scarfing plants, pulverized fuel- and stoker-fired boilers, carbon black production, refuse incinerators, and foundry knock-outs.

1850 APTIC NUMBER 15581

Cramer, Owen R.
DISPOSAL OF LOGGING RESIDUES WITHOUT DAMAGE TO AIR QUALITY. Weather Bureau, Salt Lake City, Utah. Technical M-WBTM WR-37, 9p., March 1969. 14 refs.

Techniques other than burning can not be applied to the heavy slash of old-growth Douglas-fir forests. Consequently, in the interest of air conservation, slash burning guidelines must be established. Preferably, the slash smoke column should be discharged into an actively condensing and precipiating cloud system, thereby assuring a short air life for the combustion products most of which are water soluble or act as condensation nuclei. Success in applying such a guideline will require a precision in scheduling the burn that is based on accurate prediction of weather conditions affecting the burning operation and smoke dispersion and on detailed monitoring of the pollution load in various atmospheric layers. The forecasts must indicate expected surface weather details and upper air temperatures indicative of the degree of air stratification over the forest areas throughout the burning period. From these forecasts, fire-control agencies could estimate the expected convective column heights from slash firs at various elevations. Burning would then be allowed only in areas producing a smoke plume high enough to exhaust into a layer where wind trajectories provide adequate dispersion and transport of smoke. Though not applicable to most pollution sources, this meteorological management approach is feasible in the Pacific Northwest.

1851 APTIC NUMBER 20857

Crocker, Burton B.
PREVENTING HAZARDOUS POLLUTION DURING PLANT CATASTROPES. Chem. Eng., 77(10):97-102, May 4, 1970. 5 refs.

A plant handling toxic materials must plan to prevent hazardous pollution during sudden and unexpected occurrences such as equipment malfunction, power failure, failure of cooling water, fire, flooding, and thick fogs which can lead to high ground-level concentrations. The necessary provisions, which will vary from one plant to another, are illustrated by the example of a plant in which hydrocarbon liquids are reacted in the presence of anhydrous hydrogen fluoride. To prevent high ground concentrations in the absence of thermal lift, provisions were made to keep the flare stack ignited by installing flare tips and pilots suitable for operation in hurricane winds. A flare-ignition system remotely operated in conjunction with a flare-flame-monitoring system warns the operator of flame failure. Reliability of the watercooling system on the HF recovery column is insured by the presence of three water-cooling pumps with suitable automatic

controls, and a device to cut off the flow of process heat to the reboiler whenever there is no cooling-water flow. An oversize fluoride scrubber handles larger then normal flows of HF through the vent line. Fire hazards are reduced by insulating all vessels containing HF. To protect against excess pressure in the storage tank, it is equipped with a pressure relief valve venting into the common HF manifold leading to the drowning towers and flare stack.

1852 APTIC NUMBER 20150

Darley, Ellis F. and John T. Middleton
AIR POLLUTION FILTERS FOR GREENHOUSES. Calif. Agr., 15(11):4-5, Nov. 1961.

To fully avoid damage from photochemical air pollution to greenhouse-grown crops, adequate summer cooling as well as filtration through activated carbon is required. The development of a combination filter to meet these needs is described. The unit consists of a rotary drum type evaporative cooler with squirrel-cage blower enclosed in a galvanized metal box, two sides of which are fitted with commercial, folded type, activated carbon panels and suitable oil-treated glass fiber dust filters. Certain features of the unit lower its initial costs and simplify inspection and filter replacement. The size of the unit varies with the size of the area being controlled, but it should provide one 2 x 2 ft. filter panel for each 1000 cu ft volume in the greenhouse, with a blower of corresponding size. The basic principle involved in filtering is to keep the interior of the glasshouse under positive air pressure at all times with as low a flow as possible and to supply more cfm only as cooling is required. As the cfm increase during cooling, provisions should be made for escape of the additional volume of air over and above that needed to keep the house under positive pressure.

1853 APTIC NUMBER 18170

Davies, D. T.
COAL PYRITES. J. Inst. Fuel (London), 21(331):301-311, 331, Aug. 1948. (Presented at the North-Eastern Sect. Meeting, Inst. Fuel, Newcastle-on-Tyne, Feb. 2, 1948.)

A review is presented of wartime development of sulfur recovery from coal in the United Kingdom. The necessity of using coal pyrite was due to the limited amount of sulfur imported during World War II. A total of 115,000 tons of sulfur were recovered by eight operating plants in addition to more than 140,000 tons of coal which would normally have been discarded. The pyrites recovered contained 40 to 42% sulfur and provided only 5% of the sulfuric acid trade's requirement. The pyrite removal methods of all the operating plants are described. All plants utilized a crushing technique which involved pulverization of the coal and separation of the pyrite by specific gravity and screening. Pyrite recovery averaged 60 to 75%. The 1939 installation costs were recovered by 1946, and seven of the original eight plants are still in operation in 1948.

1854 APTIC NUMBER 20016

Davis, H. E. and J. J. Clifton
A NEW METHOD FOR IN SITU TESTING HIGH EFFICIENCY AIR FILTERS USING CONDENSATION NUCLEI AS THE TEST AEROSOL. Filtration Separation (Purely), 1966: 473-497, 499, Nov./Dec. 1966. 18 refs.

A new method of determining the efficiency of installed high efficiency filters using easily transportable equipment is described. The test is performed by using a Pollak condensation nucleus counter to measure the concentration of condensation nuclei both upstream and downstream of the filter under test. The nuclei are easily generated using a Bunsen burner flame. Calibration tests show this new testing to be not more than a factor or two different from a complementary sodium flame test. Any differences are always such that the penetration of nuclei appears to be higher than that of a sodium chloride cloud. Since in situ testing is meant to detect changes in penetration rather than absolute penetration, the fact that the method is not an absolute one is considered of little consequence. Problems with the method are discussed, including insufficient nuclei upstream, fan proximity, and ingress of unfiltered air. Problems of penetration anomalies, encountered in test development are considered in an appendix.

1855 APTIC NUMBER 20130

Deeter, W. F., H. D. Daigh, and O. W. Wallin, Jr.
AN APPROACH FOR CONTROLLING VEHICLE EMISSIONS. SAE (Soc. Automotive Engrs.) Trans., 77(2):1304-1326, 1969. 9 refs. (Paper 680400.)

A prototype for controlling tank and carburetor evaporative emissions is a mechanical storage system relying on engine cycle events for storage and disposition of vapors. The central component is a storage-evaporator located on the firewall under the dash. This device is connected to a carburetor bowl by a skimming line and to a fuel tank vent by a vapor line. Another vapor line connects the separator to the crankcase or crankcase ventilation system. A prototype system for controlling nitrogen oxides in exhaust is mechanical and utilizes the principle of exhaust recirculation. The hot exhaust is taken directly from the heat riser, passed through a control valve, then ducted down each main runner of the intake manifold. The recycle rate control valve is actuated by throttle linkage. Both systems were installed in six late-model cars and evaluated in road tests and on the chassis dynamometer. The proposed federal standard of 6 g per test was the criterion of evaporation losses. An 80% reduction was the target for nitrogen oxides control. Evaporation losses were less than 1 g per test. However, the vapor recovery system increased carbon monoxide in the exhaust by about 0.1%. Reductions of nitrogen oxide emissions were 80% and higher. The nitrogen oxide recovery system did not increase concentrations of hydrocarbons and carbon monoxide in the exhaust.

1856 APTIC NUMBER 18143

Dennis, Carl
HOW MUCH WILL POLLUTION CONTROL COST YOU. Elec. Light Power,

p. 84-85, June 1969.

Some of the alternatives and equipment available to industry to comply with air pollution control legislation were discussed in reference to overall control cost. To determine the economics of several "front-running" SO2 removal or dispersal systems, EBASCO evaluated four different types for plants of about 800 mw capacity. Included were systems by Combustion Engineering, Foster Wheeler (Universal Oil Products), Chemico, and the tall-stack system. The fourth had the lowest capital cost and the lowest operating cost; this system, however, limited station capacity and sulfur content of fuel. Calculation of fuel costs was complicated by some utilities having a choice of either high or low sulfur coal. The single fuel plant could reduce sulfur content by more sophisticated preparations at the mine or remove sulfur during the pulverizing process.

1857 APTIC NUMBER 20854

Dept. of Health, Education, and Welfare, Washington, D. C.
THE COST OF CLEAN AIR. Combustion, 41(10):25-32, April 1970.
10 refs.

The future costs of controlling sulfur oxides and particulate emissions from fuel combustion and selected industrial processes are reported. All estimates are based on the assumption that control will be achieved by applying the techniques already in use. There are three general approaches to controlling emissions from fuel combustion: fuel changes, stack gas cleaning, and improvements in combustion efficiency. Combustion source estimates are based on the assumption that all reduction in sulfur oxide emissions will be achieved through fuel substitution, and reduction in particulates through stack gas cleaning. Particulate emission control from industrial process sources is assumed to be achieved with electrostatic precipitators, cyclones, wet scrubbers, and fabric filters. Cost analysis for commercial fuel combustion is based on area fuel prices. Both investment and annual costs have been estimated: investment cost includes the price of control equipment and installation costs; annual cost is the sum of depreciation of the investment cost, capital-related costs, and operating and maintenance costs.

1858 APTIC NUMBER 20049

(Inventor not given.)
PROCEDURE FOR MANUFACTURING AN OXIDATION CATALYST USEABLE AT AN ELEVATED TEMPERATURE, PARTICULARLY FOR PURIFICATION OF EXHAUST GASES OF COMBUSTION ENGINES AS WELL AS PRODUCTS SIMILAR TO THOSE OBTAINED BY THE PRESENT PROCEDURE OR A SIMILAR PROCEDURE.
(Procede pour la fabricaton d'un catalyseur d'oxydation utilisable a temperature elevee, en particulier pour la purification des gaz d'echappement des moteurs a combustion, ainsi que les produits conformes a ceux obtenus par le persent procede ou procede similaire). Text in French. (Deutsche Gold- und Silber-Scheideanstalt vormals Roessler (West Germany)) French Pat. 1,467,334. 4p., Dec. 19, 1966. (Appl. Feb. 3, 1966, 10 claims).

A procedure is presented for manufacturing an oxidation catalyst useable at elevated temperatures, particularly for purifying exhaust gases of industrial installations and of internal-combustion engines with air-intake, by means of combustion of impurities which can be oxidized to carbon dioxide and water vapor. This procedure is characterized by the fact that an aluminimum oxide is blended with oxides of heavy metals, resulting in a catalyst which keeps its efficacy for a long period of time at elevated temperatures. The Al oxide is blended with such share of mixed oxides of heavy metals that the proportion of the heavy metals, expressed in terms of the oxides, exceeds 50 weight %, and lies preferably between 55 and 90 weight %. The mixed oxides of heavy metals are blended with one of the following elements: Be, Mg, Ca, Sr, or Ba in concentrations of, preferably, 0.5 to 10 weight %. The mixed oxide of heavy metals is replaced by a combination of at least two metallic components, one of which is Cr and the other is one the rollowing elements: Ti, Va, Mn, Fe, Co, Ni, Cu, or Zn. As a mixed oxide of heavy metals, Cu-Cr oxide is use, either in the form CuCr2O4, or in the form CuCrO2. The two oxides which are the basic materials are separately prepared in powder form after which they are mixed with a binder to be shaped into small rods or tablets. The final roasting of the catalyst in the temperature interval between 400 and 800 C takes place in an O2 atmosphere. The catalyst is compressed and roasted in such a manner that the tablets have a crushing strength of more than 10 kg per tablet.

1859 APTIC NUMBER 20032

Dickinson, W. A. and J. L. Worth
WASTE GAS CLEANING SYSTEM AT SPARROWS POINT PLANT'S NO. 4 OPEN HEARTH. Open Hearth Proc., vol. 47:214-225, 1964.

Basic oxygen furnaces will someday replace open-hearth furnaces in steel refining, but until then, open-hearth furnaces with oxygen lancing will continue to emit a heavy dark reddish iron-oxide plume that accompanies the furnace waste gas products. Elimination of this plume is costly, no matter which method is used, whether it is a bag house filter scrubber, or precipitator. The waste gas cleaning system installed at No. 4 Open-hearth Shop at Sparrows Point, Md. is described, together with its operation and required modifications. A schematic view of the waste gase cleaning system installation is shown. The dirty gas from each of the 7 open-hearth furnaces located in the shop passes through a checker chamber and a duct to a waste-heat boiler and is then pushed by a fan into a collecting main. Spectacle valves are located at each of the 7 entrances to the main, and explosion heads are mounted at each end and along it. Blanked connections were installed along the main for future installation of a steam jet system for removal of dust accumulations from the main. Six ducts carry the five gases from the main to dry, lane-type electrostatic precipitators mounted in 6 29 ft. wide, 27 ft long, and 34 ft high precipitation chambers. Even though most of the dust is collected on the collecting-electrode plates, both they and the discharge electrodes made of barbed wire held taut by weights attached to their lower ends must be periodically wrapped to be kept clean. The dislodged dust drops to the bottom of the chamber into an elaborate dust conveying and storage system.

1860 APTIC NUMBER 18154

Diehl, Eilv R.
SO2 REMOVAL -- STATE OF THE ART. Nat. Eng., 73(6):6-10, June 1969.

A general review of SO2 removal from combustion gases is presented. Sulfur in coal occurs in two main forms. The organic sulfur is bound as an integral part of the coal, and the pyritic or mineral sulfur, occurs in discrete particles in the coal mass. An appreciative amount of pyrite sulfur could be freed from the coal by utilizing a pulverizer. The coal is cycled inside the pulverizer, and the pyrite is separated by gravity. SO2 emission may also be controlled by its removal from the flue gases. One method is to combine limestone or dolomite with the flue gases. This method has a 20%-40% possible removal efficiency. Additives plus wet scrubbing is another method; the combined process was reported to be 95% effective. In the alkalized alumina process, flue gas contacts a highly-reactive solid absorbent which binds the SO2 as a sulfate. Regeneration of the absorbent for recycle releases hydrogen sulfide which is converted to elemental sulfur. Catalytic oxidation is another method of SO2 removal, involving the oxidation of SO2 to SO3 in a higher temperature reactor. With this method, sulfuric acid is the recovery product.

1861 APTIC NUMBER 18155

Donovan, J. H., and P. J. Stuber
THE TECHNOLOGY AND ECONOMICS OF INTERPASS ABSORPTION SULFURIC ACID PLANTS. Preprint, American Institute of Chemical Engineers, New York, N. Y., 24p., 1968. 13 refs. (Presented at the AICPE Annual Meeting, Los Angeles, Calif., Dec. 1-5, 1968.)

Sulfuric acid plants can be designed to convert 97.5% of the SO2 entering the converter to SO3 by utilizing the interpass absorption or double catalysis principle. Present and proposed air pollution standards in some areas require as little as 0.05% SO2 in exit gases. Standard plants with 98% conversion efficiency yield exit gas concentrations of 0.2% SO2 or slightly less, making the interpass absorption process necessary to meet maximum pollution allowances. In this system, the process gas is passed through two or three stages of a normal converter, cooled in heat exchangers, and sent on to an absorbing tower to remove SO3. The gas stream is reheated to a suitable temperature, passed through the final stage or stages of the converter, and on to the final absorber. This procedure results in a low concentration of SO3 in the gas in the last stage of the converter and a greatly reduced equilibrium content of SO2. The chief advantages of the interpass process are lower SO2 in the exit gases, higher yield on raw materials, and lower volume of process gas due to higher capital and operating costs, less waste heat recovery in S-burning plants, less flexibility in processing low strength by-product gases, and a more complicated plant to operate.

1862 APTIC NUMBER 20044

Ebersole, G. L. and G. E. Holman
LUBRICANT-CLOSED PCV SYSTEM RELATIONSHIPS INFLUENCE EXHAUST EMISSIONS. SAE (Soc. Automotive Engrs.) Trans., 77(1):417-424, 1969. 22 refs. (Paper 680113.)

Low quality motor oils used in engines equipped with closed positive crankcase ventilation (PCV) systems can cause PCV plugging and substantially higher concentrations of exhaust hydrocarbon and carbon monoxide than high quality motor oils. The increase in exhaust emissions with low-quality motor oil results from deposits in the PCV valve, carburetor venturi, and carburetor throttle body, while high quality oil controls the deposits in these areas. Differences in air and fuel flow in an idling engine with a clean PCV system and in one with a plugged PCV system must be considered in developing an explanation of the way PCV system plugging could increase exhaust hydrocarbon and carbon monoxide emissions. Concentrations of HC and Co at idle increased with progressive plugging of the PCV valve and with accumulation of carburetor deposits, but decreased as the ignition timing was advanced. Compared with hydrocarbon emissions with a clean carburetor, idle emissions were increased by throttle body deposits more than by venturi deposits at low PCV valve plugging levels, while carbon monoxide emissions were increased more with venturi deposits than with throttle body deposits when individually compared with CO emissions obtained with the clean carburetor.

1863 APTIC NUMBER 17837

Edwards, R. L., P. E. Johnson, and C. Yao
CONTROL AND REDUCTION OF OIL MISTS FROM MECHANICAL VACUUM PUMPS. A GLOVE BOX FIRE SAFETY APPLICATION. Factory Mutual Research Corp., Norwood, Mass., AEC Contract AT(11-1)-1393, 24p., 1969. 4 refs.
CFSTI: TID-25085

Oil mists exhausted from mechanical vacuum pumps into glovebox exhaust systems can clog or violate high efficiency exhaust filters, and deposit oil film in duct-work that presents a fire hazard. A means of mist control was developed. The causes and characteristics of oil mist formation were examined. Three methods of resolving the problem were investigated: simple modification of existing pumps, substitution of silicone oils for conventional pump oils, and collection and removal of oil mists from pump exhaust lines. Within the scope of methods investigated, mist formation could not be prevented; some method of mist control would be needed. Several types of mist collectors were evaluated. Depending on the capacity of the pump and its application, a York demister, a Pall cartridge filter, or a high efficiency air filter, in the exhaust line of mechanical pumps, were recommended for collecting oil mists. Recommendations were also made on the arrangement of mist collectors for safe, efficient operation. (Author abstract modified)

1864 APTIC NUMBER 20063

Ehrlich, Shelton
AIR POLLUTION CONTROL THROUGH NEW COMBUSTION PROCESSES. Environ. Sci. Technol., 4(5):396-400, May 1970.

More than 6000 megavolts of new coal and oil-fired power generating capacity will be brought on line in 1970, and combustion at an elevated pressure is proposed to reduce oil process sulfur oxide emissions from these yet unbuilt boilers. Fuel would be burned at a pressure of 6 atmospheres in one design concept for a 480

megavolt power station. Fewer boiler tubes are need to absorb heat from high pressure gas than from a hot gas at atmospheric pressure which would improve capital cost, while efficiency improvement arises from the power generated by the gas turbine in excess of that required to compress the combustion air. A sulfur oxide removal process for such a high pressure boiler would handle only one-eighth the volume of gas of an equivalent atmospheric pressure boiler and consequently treat it more intensively. Supercharging does not appear to be an immediate prospect for coal, but fluidized-bed combustion of coal at atmospheric pressure and the removal of sulfur oxides before or as they are formed does have immediate potential. Combustion rate may be five times the value of that in a conventional boiler, and effective average heat flux into the boiler tubes may also be five times as high. Combustion takes place at temperatures low enough (1600 F) to preclude the formation of corrosive ash compounds that tube metals may be less costly, and peak heat flux may be two thirds that found in a conventional boiler with thinner tubes of lesser alloys required. The Ignifluid boiler was developed in France as a very effective fluidized-bed combustor with a moving grate for ash removal.

1865 APTIC NUMBER 17974

Eifel, Paul J.
COMPARATIVE COSTS OF LNG SURFACE TRANSPORTATION. Gas Age, 1968: 20-23, Oct. 1968. 5 refs. (Presented at the first International Conference on LNG, Chicago, Ill., April 1968.)

Liquefied natural gas (LNG) is being utilized for diverse purposes, from peak shaving to industrial heating applications, from supersonic transport fuel to railroad locomotive power. Methods have been defined or are being established that permit safe, yet economical, transportation of all types of low-temperature commodities. Though the available types of land transportation equipment are varied in detail, they can be classified into the categories of railroad tank cars; highway tank trailers; highway tank truck; and transportable vessels (usually skin mounted). The first and second category constitute the bulk movement equipment, while the third and fourth are used more for short-haul distribution involving smaller quantities. The approximate maximum capacities and comparative first costs, in dollars per Mcf capacity, of the four categories are given. A description of a railroad tank car designed specifically for the transportation of LNG and capable of carrying 113,750 lbs of LNG corresponding to roughly 2,750,000 cu ft of gas, is given, and the prospective railroad shipping rates are discussed. An optimum highway trailer is available for transporting LNG at low pressure. It will carry 18,200 lbs of LNG, corresponding to about 438,000 cu ft at an operating pressure of 30 lb/sq in. In considering the economic aspects of bulk shipping of LNG, the 'turnaround'time for a railroad car and a highway trailer play an important role. Of the many factors affecting that of the former, the most important are length of trip, number of handling railroad lines, number of junction points or yards to be negociated, railroad cooperation, and shipper persistence. On the other hand, that of the latter is almost entirely dependent on the shipper and his dispatcher.

1866 APTIC NUMBER 20103

Eltinge, Lamont, Frederick J. Marsee, and A. Joel Warren
POTENTIALITIES OF FURTHER EMISSIONS REDUCTION BY ENGINE MODIFICATIONS. SAE (Soc. Automotive Engrs.) Trans., 77(1): 463-480, 1969. 33 refs. (Paper 680123.)

The combination of lean mixtures to provide oxygen in the exhaust and of exhaust heat conservation to enhance exhaust reactions yields significant exhaust reaction and lower hydrocarbon emissions. Adequately uniform mixtures are required; injection of additional air into the exhaust is not required. An engineering prototype incorporating such a combination gives low emissions (about 90 ppm hydrocarbons and 0.4% carbon monoxide) with good driveability and fuel economy. This approach should permit the gasoline engine to meet emission targets reflecting a reasonable balance of costs and benefits, while retaining essentially intact all its other advantages for the motoring public.

1867 APTIC NUMBER 20062

Exley, L. M.
A PRACTICAL REVIEW OF RESIDUAL OIL FIRING PROBLEMS AND SOLUTIONS. Combustion, 41(9):16-23, March 1970. 9 refs.

Power-plant boilers firing residual fuel oil are discussed with respect to fireside corrosion and boiler slagging, cold-end corrosion, and air pollution. Most residual fuels contain vanadium, sodium, and sulfur compounds. Upon combustion, these elements form low-melting ash deposits on superheater and reheater tubes, supports, hangers, and spacers. Corrosion usually occurs with steam temperatures above 1000 F, but wastage has been reported at 950 F. In the low-temperature superheater section, $SO_3$ is catalytically generated. Sulfuric acid is formed by condensation at the cold end of a boiler as the gases encounter cooler metal temperatures. When flue-gas temperatures approach the acid dewpoint and condensation occurs, ash particles agglomerate and eventually pass out of the stack. Under these conditions, the surrounding area is subjected to fallout of greenish acid deposits, small black particles, or even large masses of highly corrosive material. Fireside corrosion can be eliminated and formation of $SO_3$ inhibited by adding magnesium oxide to the fuel oil. The MgO reacts with vanadium to form a dry and noncorrosive ash, while poisoning the catalytic effect of vanadium in converting $SO_2$ to $SO_3$. A coating of MgO on water wall tubes makes it possible to operate boilers on much lower excess air. In combination with MgO additives, low-excess air firing eliminates acid smut fallout by lowering acid dewpoint. For a unit burning 10,000 bbls/day, a decrease of excess air from 20 to 5% can result in a saving of $73,000 per year.

1868 APTIC NUMBER 17813

PROCEDURE FOR DESULFURIZING GAS MIXTURES. (Procede to our desulfurer les melanges gazeux). Text in French. (Farbenindustrie I. G.) A.-G., Frankfurt, Germany.) French Pat. 738,747. 6p., Dec. 29, 1932. (Appl. June 17, 1932, 16 claims).

Hydrogen sulfide is separated and recovered from gas mixtures

containing it by scrubbing the gases with a liquid and heating the liquid product to drive off hydrogen sulfide. The scrubbing liquid consists of organic acids mixed or combined with basic compounds of alkali or alkaline-earth metals, and must be almost completely free of chlorine. When the gas mixture contains a substantial proportion of carbon dioxide, the scrubbing mixtures should contain approximately equivalent proportions of acids and bases. When the gases do not contain carbon dioxide or only a small amount of this gas, the scrubbing mixture should contain an excess of basic compounds. Among the acids that can be incorporated into such a liquid mixture are the various amino acids, mixtures of amino acids and imino acids, or the phenols. The basic compounds contained in the liquid mixture can be hydroxides, oxides, or carbonates of such metals as magnesium and beryllium. The reaction should take place at a temperature not exceeding 90 C. If the gas mixture contains both hydrogen sulfide and carbon dioxide, and it is desired to recover both these gases, the former can be recovered at room temperature and the carbon dioxide, by heating above 90 C. The washing liquid circulates continually between one or more washing towers and one or more separators, condensers, and heat exchangers. The apparatus is made of lead, chrome, steel, and nickel or aluminum.

1869 APTIC NUMBER 17908

Fehr, Karl
METHOD FOR THE CLEANING OF DRY OR MOIST CARBON CONTAINING GASES. (Verfahren zur Reinigung von trockenen oder feuchten kohlenstoff-tragenden Gasen). Text in German. W. German Pat. 950,951. 2p., June 6, 1952. 1 ref. (4 claims).

A method for cleaning dry or moist carbon containing gases, preferably flue gases, has been devised. The gases are passed through halogenated tar products and/or mineral oil products at optional temperatures. Such tar products and/or mineral oil products must be selected which are suitable for binding sulfurous acid, soot, and tary substances. They can be solved in organic solvents. They ought to be used preferably in solution of chlorinated aliphatics and/or chlorinated aromatics. The mixing ratio of the products and the solvent may vary. Prior to passing the gases over the halogenated tar and/or mineral oil products, they are mixed with oxidizing gases. The method may be performed in various ways. The gases may be either injected into the solvent or passed counter-current to the solvent in a bubble tower. The solvent can be re-used.

1870 APTIC NUMBER 18145

NEW GAS SCRUBBER REMOVES 0.1 MICRON DUST. Filtration Separation (Purley), 6(3):308, May-June 1969.

Peabody Ltd. has developed a high-efficiency scrubber which, when fitted with the new venturi agglomerating slot storage, removes gas, dust, and fume down to the 0.1-micron range. The scrubber recovers 99% of all particulate matter down to 1 micron with minimum pressure loss. It also provides a simple and effective means of gas absorption. Such contaminants as SO2, HCl, and Cl2 are readily removable.

1871 APTIC NUMBER 17915

Finney, J. A. Jr. and Jean DeCoster
A CLOTH FILTER GAS CLEANING SYSTEM FOR OXYGEN CONVERTERS. Iron Steel Engr., 42(3):133-139, March 1965.

A fume removal system using cloth filters and a refractory accumulator somewhat similar to a blast furnace stove has advantages in that no water is needed for operation and electric energy consumption is low. Capital equipment costs are competitive. A cloth filter gas cleaning system that was developed in France is described. The system is illustrated. The key to this system is entirely in the method by which the gases are cooled from the very high temperatures at which they leave the furnace hood to a temperature at which they can be treated in a fabric filter. Refractory surfaces in the accumulator absorb heat from the gases, cooling them to a maximum exit temperature of approximately 250 F. This temperature limitation is required in connection with the synthetic fabric filter used to separate the entrained dust from the gases. The system depends on the cyclic nature of the basic oxygen process for its operation. As the accumulator cannot absorb heat indefinitely, it must be cooled in order to prepare it for the following cycle. Cooling is accomplished through use of a back blowing fan which forces atmospheric air counter-currently through the accumulator. This air absorbs the heat stored in the refractory packing. Thus, heat absorbed during the blowing cycle is discharged directly to atmosphere as hot air during the nonblowing portions of the cycle. This technique avoids the use of water. A reproduction of a temperature chart taken at an installation in France is given.

1872 APTIC NUMBER 17914

First, Melvin W. and Leslie Silverman
PREDICTING THE PERFORMANCE OF CLEANABLE INDUSTRIAL FABRIC FILTERS. J. Air Pollution Control Assoc., 13(12):581-586, Dec. 1963. 12 refs. (Presented at the 56th Annual Meeting of APCA, Detroit, Michigan, June 10-13, 1963.)

The performance characteristics of cleanable cloth filters used for process effluents are discussed. Information from many sources are gathered and a few general rules governing industrial filter performance are formulated. The major factors of importance in rating the performance of dust collecting equipment are the following: (1) collection efficiency; (2) air flow resistance or power requirements; (3) maintenance requirements; (4) service life; and (5) purchase price or installed cost. Filter efficiency and resistance to temperature and corrosive effects can be predicted with a satisfactory degree of accuracy and reliability to satisfy commercial requirements. When it comes to predicting air flow resistance or the cloth to air ratio that is needed for an acceptable filter resistance, experience alone is the principle guide. Woven monofilament fabrics must be cleaned gently if they are to retain high particle retention efficiency. This means that these materials are best when used at low air-to-cloth ratios (2 to 5 cfm/s ft). For high filtration rates (10 to 30 cfm/sq ft), intensive cleaning is needed and dense, highly-retentive

felts are required. All cleanable industrial cloth filters are capable of giving whatever collection efficiency may be desired and all can operate satisfactorily over a wide range of pressure drops.

1873 APTIC NUMBER 16161

Ford, Eric
COTTAM POWER STATION PROVIDES NEW APPROACH TO ASH AND DUST HANDLING. Steam Heating Eng. (London), 38(451):6-10, June 1969.

The dust and ash handling arrangements at Cottam Power Station are discussed. The systems are designed to remove 3960 tons/day of dust and 960 tons/day of ash in a 400 minute period. Dust sources are the precipitators, the economizers, and the air heaters. Dusts are drawn by vacuum into the water-operated ejector-wetting unit, and then discharged to a sluiceway. An outdoor sump receives the discharge from the sluiceways, and two agitator nozzles keep the dust in solution. The wet dust is pumped to a lagoon 4000 ft away. The scheme for the removal of ash from furnace bottoms calls for the pumping of slurry from the ash sump up to a receiving tank hopper where it passes over screens to remove material 0.25 in. in diameter. This material is discharged direct to the ash compound for removal. Underflow from the screens gravitates to a recirculating sump where it is pumped by Vacseal pumps to hydrocyclones and then to dewatering tanks. The hydrocyclones or hydraulic cyclones discharge the solids in the form of a concentrated slurry into a dewatering tank. This consists of a chaintype dewatering conveyor which carries the 0.25 in. material up an incline to allow drainage and discharges it via a chute to the ash compound.

1874 APTIC NUMBER 16191

Galstaun, L. S., B. J. Steigerwald, J. H. Ludvig, and H. R. Garrison
WHAT DOES IT COST TO DESULFURIZE FUEL OIL. Chem. Eng. Progr., 61(9):49-58, Sept. 1965. 14 refs.

The economics of restricting the sulfur content of residual fuel oil were investigated by the application of linear programming and mathematical modeling to samples of California crude oil; and mixtures of Kuwait crude and fuel oil. Computer simulation, using linear programming or similar techniques, is necessary to achieve an optimum balance among a refinery's processing units. The refinery model was structured to use the hydrogen by-product of catalytic refining units for various hydrogen-consuming units. Additional needs were met by a steam-hydrocarbon reforming unit which used by-product gases such as fuel and feedstock. When fuel oil sulfur restrictions were severe, the model diverted to the fuel pool a large part of the marginal butylenes and propylenes normally converted to gasoline. The cost of meeting any sulfur restriction was obtained by comparison with a base case having no residual fuel oil sulfur unit; cost curves were plotted to represent the differential costs divided by the total barrels of fuel oil produced. The study showed that manufacture of low-sulfur residual fuel oil requires an incentive pricing of $0.42 to $0.65/bbl above fuel oil produced without sulfur restriction. Since the current market price is not sufficient, imposition of a residual oil hydrodesulfurization unit will further reduce the production of fuel oil from domestic refineries.

1875 APTIC NUMBER 20017

Gamble, Charles B., Jr.
WHY LNG ALAGASCO? Am. Gas J., vol. 191-44-49, Sept. 1964. (Presented at the American Gas Association Production Conference, New York, May 25-26, 1964.)

Although liquefied petroleum gas (LPG) peak shaving plants operate successfully, the substitution of liquefied natural gas (LNG) accumulated during peak-off periods and stored near the point of use offers considerable advantages as a peak shaving method. In the first place, it eliminates an element of risk due to the high gravity of the LPG; secondly, it eliminates the compatability problem. Finally, such a facility can be constructed at a cost less than that of LPG plant. The most technically feasible plan for meeting safety and savings criteria is the storage of a natural gas as a cryogenic fluid. While some of these fluids pose problems in terms of temperature, pressure, and safety, the handling of liquid methane should involve only that of thermal shock, which is unique, not to methane, but to peak shaving operation. This factor is the major engineering problem involved in plant design. Specifications are presented for a methane facility that will have maximum output capacity of 85,000 Mcfd of gas, a storage capacity of 175,000 Bbl of LNG, and a gross liquefaction capacity of 4600 Mcfd of gas. The cost to deliver gas to the plant will be approximately one-half of the cost from a LPG facility.

1876 APTIC NUMBER 17887

Garbato, Carlo
PROCEDURE FOR CATALYTIC OXIDATION OF SULFUROUS GASES, NO MATTER HOW PRODUCED, AS A MEANS OF MANUFACTURING SULFURIC ACID AND OLEUM, USING CATALYSTS DISPERSED AS A FINE DUST IN THE REAGENT GAS AND CIRCULATING WITH IT: MEANS AND DEVICES FOR ITS APPLICATION. (Procedimento per l'ossidazione catalitica di gas solforosi, comunque prodotti, per la fabbricazione di acido solforico ed oleum a mezzo di catalizzatori dispersi in povere fine nella massa gassosa reagente, e con essa fluenti mezzi e apparecchiatura per realizzarlo). Text in Italian. (Assignee not given.) Italian Pat. 435,452. 3p., May 18, 1948. (Appl. April 11, 1946, 6 claims).

In the process of making sulfuric acid from sulfurous gases, the principle of a 'flowing' rather than a 'static' catalyst is preferred, wherein the catalyst is pulverized to a suitable particle size and is circulated directly with the gas itself throughout the apparatus. This avoids the problem, encountered with the stationary catalyst, of the accumulation of heat in the catalyst, which if not dissipated in some way or other causes the reaction temperature to rise, disturbing the relationship of SO3 to SO2, thereby reducing the yield of sulfuric acid. The preferred catalyst is an iron oxide produced by roasting powdered iron pyrite. The pyrite roasting and the SO2 oxidation take place in the same apparatus, the iron oxide produced being used immediately as catalyst for the oxidation of SO2. Catalysis

takes place in a special apparatus consisting of a metal chamber, which is cooled by the circulation of some type of fluid which absorbs excess heat produced by the reaction. The apparatus is constructed so as to resist pressures above atmospheric pressure. A partial catalysis may also be performed with a circulating catalyst wherein the process is completed with the conventional 'static' process.

1877 APTIC NUMBER 17890

Girsewald, Conway Freiher von, Hans Weidmann, and Gerhard Roesner
METHOD FOR THE RECOVERY OF CONCENTRATED SULFUR DIOXIDE. (Verfahren zur Gewinnung von konzentriertem Schwefeldioxyd). Text in German. (Metallgesellschaft A. G., Frankfurt, West Germany). West German Pat. 645,879. 4p., July 6, 1935. (4 claims).

For efficient recovery of sulfur dioxide from roasting gases, it is not sufficient to remove the sulfates formed in the organic bases by additives. It is better to prevent any sulfate formation by adding an oxide, hydroxide, sulfite, of another salt of a weak acid of an alkali metal, including ammonia and magnesium, so that the absorption mixture never attains the acidity (at least not as long as the absorption mixture is heated) at which an oxidation of free or bound SO2 to SO3 occurs with precipitation of elementary sulfur. The latter is completely converted in the absorbent to the sulfates of the organic bases used. This process can be avoided by the patented measure. A surplus amount of additive must be added to bind the entire elementary sulfur in the form of inorganic thiosulfate. After the SO2 has been driven off, an amount aliquot to 7 g Na20 of the additive should not be used for the formation of sulfate or thiosulfate. The additives are best added prior to the beginning of absorption.

1878 APTIC NUMBER 17919

Girsewald, Conway Freiherr von and Gerhard Roesner
METHOD FOR THE EXTRACTION OF SULFUR DIOXIDE. (Verfahren zur Gewinnung von Konzentriertem Schwefeldioxyd). Text in German. (Metallgesellschaft A. G., Frankfurt (West Germany)) W. German Pat. 660,256. 4p., June 24, 1936. (Appl. date not given, 4 claims.)

Sulfur dioxide is recovered from SO2 containing gases by treatment with a mixture of organic bases and water. The absorbed SO2 is then driven off by heating. Sodium compounds are added for decomposition of the sulfates forming in a side reaction in the organic bases. The continuous or discontinuous separation of the sodium sulfate solved in the aqueous fraction of the absorption mixture is also presented. The solution is cooled to a temperature of plus 2 C or less and the sulfate is separated in the form of Glauber's salt. The base is returned for re-use. by this method, losses of organic bases are avoided. With the recovery of SO2 from roasting gases with xylidine and water as absorbant, a waste water was obtained after dissociation of the xylidine sulfate with soda which contained 20.5 kg S in the form of SO4 (i.e. 205 kg Glauber's salt) and 7 kg xylidine per cu m. Upon cooling of the water to 0 C, 138 kg/cu m Glauber's salt was obtained. It was separated by centrifuging. The base (9201 from 10001) gas returned to the SO2 scrubber with 7.2 kg S in the form of SO4 and 7.3 kg xylidine/cu m.

1879 APTIC NUMBER 17961

Girsewald, Von Conway Freiher, Hans Weidmann, and Gerhard Roesner
METHOD FOR THE RECOVERY OF CONCENTRATED SO2. (Verfahren zur Gewinnung von konzentriertem Schwefeldioxyd). Text in German. (Metallgesellschaft A. G., Frankfurt (West Germany)). W. German Pat. 623, 016. 5p., July. 21, 1934. (3 claims).

The sulfates of the organic bases developing in a side reaction can be converted to insoluble sulfates by compounds of the earth alkali metals, such as the oxides, hydroxides, carbonates, neutral and acid sulfites, and other salts of weak acids of the earth alkali metals. Such additives may be added to the absorbant before or after the absorption process and at normal or higher temperature such as 70 C. The earth alkali sulfates as well as the sulfates developing through oxidation processes can be spearated by filtration or centrifuging. The liquid remaining after the separation is returned to the process. The loss of organic bases can be further reduced by bringing the waste gas developing at the absorption process and/or the SO2 obtained by heating the sulfite solution to reaction with the above additives in the presence of water. Such additives must be used which are practically free of elementary sulfur.

1880 APTIC NUMBER 20239

Girsewald, Conway Freiherr Von, Hans Weidmann, and Gerhard Roesner
METHOD FOR THE RECOVERY OF CONCENTRATED SULFUR DIOXIDE. (Verfahren zur Gewinnung von konzentriertem Schwefeldioxyd). Text in German. (Metallgesellschaft A. G., Frankfurt (W. Germany) W. German Pat. 606,447. 3p., May 7, 1933. (1 claim).

To remove the sulfur dioxide from SO2 containing gases, a mixture of aromatic bases and water is used in which the SO2 is absorbed and subsequently driven off by heating. Since water is a good solvent for oxygen, part of the sulfite is oxidized to sulfate in the presence of the organic base. When the liquid is heated, the latter does not decompose as the sulfite does but accumulates through repeated use, so that eventually the process has to be halted. This can be avoided by adding substances which form soluble sulfates with the sulfates of the bases. The hydroxides, carbonates, sulfites or other salts of weak acids of the alkali metals including ammonia can be used for this purpose. Addition of such substances has the advantage that the organic base bound to the sulfate can be recovered. A roasting gas with 7.5% by volume SO2 and 8% O2 was scrubbed with a xylidine and water mixture (1:1). After repeated use of the absorption mixture, the sulfate content had risen to 12 g S/l and foam began to form. Therefore Na2SO2.7H2O was added. After the SO2 had been driven off, the xylidine contained 0.8 S/l while the water contained 25 g S/l in the form of SO4 and 2.2 g xylidine.

1881 APTIC NUMBER 20802

Glaeser, Melvin L. and Earl L. Wilson
DUST DISLODGING SYSTEM FOR ELECTROSTATIC PRECIPITATORS. (Koppers Co., Inc., Monroeville, Pa.) U. S. Pat. 3,483,669. 5p., Dec. 16, 1969. 15 refs. (Appl. Sept. 13, 1965, 2 claims).

Structural failure is often induced in the electrode support system of conventional electrostatic precipitators by the magnitude of vibration necessary to dislodge dust which tends to build upon horizontal flat surfaces. Provision is made for inhibiting such dust accumulations and removing those that occur. Auxiliary members with horizontally inclined surfaces overlay the top surface of the center support. The center support is joined to the electrostatic precipitator shell in a conventional manner but is not vibrated. Vibration is induced in the structural angle by a rapping source joined to the precipitator shell. The structural angle is mounted so that its apex forms a cone with the flat top surface of the center support. Joined to and extending from the structural angle are rod-like fingers spaced apart so as to overlay the top surfaces of the collector plates. The ends of the fingers and the structural angle are loosely guided so that vibration dislodges dust from them without the vibration being transmitted to the electrode support structure. Inclined surfaces inhibit dust accumulation and the vibration dislodges whatever dust does accumulate.

1882 APTIC NUMBER 20096

Hashimoto, Kiyotaka
THE POINT OF PLANNING AND ITS EFFECT ON OPERATION RESULT OF AN ELECTRIC PRECIPITATOR IN VARIOUS INDUSTRY SMOKE ABATEMENT (IV) - TREATMENT FOR WASTE GAS OF IRON AND STEEL INDUSTRY. (Gyoshubetsu ni miru denkishujinsochi no setsubikeikaku to untenkoka (IV) - seitetsu seiko to sono haigasu no jogai). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 3(2):93-102, Feb. 15, 1967. 24 refs.

The waste gas from the iron and steel industry must be cleaned by precipitating equipment according to the properties of smoke and dust. In the manufacture of pig iron, dust is produced in the blast furnace, coke oven, fire extinguishing tower, and sintering furnace. Gas from the blast furnace is most effectively cleaned by an electrical precipitator. Today, a wet electric precipitator is used because of its high rate of precipitation in comparison with the dry electric precipitator. Gas from the coke oven has a higher calorific value than that from a blast furnace. It is cleaned by the double treatment of hot-detarer and cold-detarer. The steel making methods of a revolving furnace and of electricity have been replacing the method of an open-hearth furnace. Although efficiency has increased, the red-brown smoke, mainly composed of oxidized iron, becomes thick and the quantity of waste gas increases. The smoke produced by making steel with oxygen is mainly composed of burned iron fume. The gas should be cooled by a stabilizer and then gathered by a dry electric precipitator. Fumes in the waste gas of a cupola furnace cannot be eliminated in any other way.

1883 APTIC NUMBER 20097

Hashimoto, Kiyotaka

THE POINT OF PLANNING AND ITS EFFECT ON OPERATION RESULT OF AN ELECTRIC PRECIPITATOR IN VARIOUS INDUSTRY SMOKE ABATEMENT (III) TREATMENT FOR WASTE GAS OF A COMBUSTION FURNACE AT A THERMAL POWER PLANT (II). (Gyoshubetsu ni miru denkishujinsochi no setsubikeikaku to untenkoka (III) - karyokuhatsudensho no nenshoki haigasu no shori (sono II) ). Text in Japanese. Kogai to Taisaku (J. Pollution Control), 2(10):701-707, Nov. 15, 1966. 11 refs.

Several factors can cause the electrical resistance of dust in the waste gas of a powdered-coal burning boiler to vary considerably. When the resistance is too high, the discharging condition in an electric precipitator becomes unstable. Several methods of reducing the electrical resistance of dust are mentioned. The amount of dust in the hopper should be periodically checked and removed as a precaution against accidents. The problems encountered with rapping on the electrodes of an electric precipitator are also discussed. The matters of primary concern in heavy oil burning for thermal power generation are injury from sulfur dioxide, sulfur trioxide, smut, or plume. To prevent injury from SO3, the sulfur in heavy oil should be removed before burning; but at present, no economical methods are available. Since SO3 is contained in fine dust, a combination of an electric precipitator and a cyclone should be used as a dust collector for a heavy-oil-burning boiler. Due to the special properties of the dust, some problems arise when operating the precipitator.

1884 APTIC NUMBER 17838

Havens, Richard and Karl C. Dean
CHEMICAL STABILIZATION OF THE URANIUM TAILINGS AT TUBA CITY, ARIZ. Bureau of Mines, Washington, D. C., Rept. of Investigations 7288, 11p., Aug. 1969. 5 refs.

Acidic and basic uranium leach plant residues located on the Navajo Indian Reservation, Tuba City, Ariz., were successfully stabilized against wind erosion using a relatively low-cost chemical method. An elastomeric polymer chemical was applied to the dike areas and a calcium magnesium lignosulfonate to the beach areas of three tailings ponds. The water-soluble chemicals were applied with an automatic sprinkling system. The stabilization cost was $335 per acre for the 34.5-acre tract. (Author abstract modified)

1885 APTIC NUMBER 18140

Hawkins, Gerald
SCRUBBER LICKS TOUGH FUME PROBLEM. Plant Eng., 23(13):70, June 26, 1969.

Air pollution control with scrubbers at Champion Papers is discussed. To eliminate the low-volume, highly concentrated sulfur-containing pollutants, two gas scrubbers were installed in parallel on two 600-ton black liquor evaporators used in the kraft pulping process. Non-condensable gases leave the surface condensers, pass through a pre-cooler, through jets, and into the gas scrubber. The scrubber's effectiveness is excellent and can easily be evaluated by observing the exhaust

vents for plume evidence.

1886 APTIC NUMBER 18142

LABORATORY TESTS AID AIR POLLUTION CONTROL. RECENT WORK IN AUSTRALIA. Heating and Ventilating Eng., 42(502):588, May 1969.

Future equipment to be installed at the new Liddell power plant, New South Wales, Australia, to prevent air pollution is described. Pulverized coal will be burned at a rate of 700 to 800 tons/hr, giving rise to 175 to 200 tons/hr of very fine fly ash. The coals from 14 seams were tested for their fly ash behavior, and the two major seams which behaved the least satisfactorily will be burned at Liddell. An electrostatic precipitator will remove 98.5% of the ash from the flue gases. Tests run on this station after its completion should aid in improving the efficiency of established power stations.

1887 APTIC NUMBER 18160

Herod, Buren C.
NCSA'S DUST CONTROL SEMINARS REFLECT INDUSTRY'S CONCERN WITH EFFECTIVE MEASURES. Pit and Quarry, 61(12):118-124, June 1969.

Several reports given at two seminars on dust control technology for producers in the stone industry are reviewed. Dry mechanical collectors, including the inertial, settling chamber, and centrifugal, were identified. Centrifugal collectors are most affected by particle size. They are most effective in collecting material in the 10- to 200-micron range. Wet scrubbers usually act as an after cleaner for mechanical collectors. Various inherent advantages of wet scrubbers were cited. Scrubbers have the ability to collect particles in the submicron range. A comprehensive review of fabric collector fundamentals covers the theory of fabric filtration, types of fabrics, factors in the selection of proper fabric, operation of this type of collector, and proper maintenance procedures. The principles of operation, along with a physical description of the basic components, plus a review of factors affecting performance of electrostatic precipitation were presented. The effective control of dust by wet suppression techniques also was reviewed.

1888 APTIC NUMBER 20825

Himel, Curtis Joseph
AIR CLEANING APPARATUS. (Assignee not given.) U. S. Pat. 3,480,262. 5p., Nov. 25, 1969. 9 refs. (Appl. Feb. 16, 1968, 7 claims).

An air cleaning and sterilizing device consisting of a series of tanks containing a cleaning liquid is described. The air is drawn through the tanks by suction. The first tank has reciprocating agitators to cause the particles in the air to absorb the liquid and sink to the bottom of the tank. The other tanks have rotating accurate tubes through which the air is forced under pressure. The tubes contain baffles to create friction with the particles and thus remove them. A rotatable tubular shaft conducts the air through the tanks, and air ducts extend between the shaft and the arcuate tubes.

1889 APTIC NUMBER 20227

Hipp, Norbert E. and John R. Westerhold
DEVELOPMENTS IN GAS CLEANING-GREAT LAKES STEEL CORP. Iron Steel Engr., 44(8):101-108, Aug. 1967.

There are many problems connected with high-energy scrubbers which are unsolved. The high-energy scrubber has made it possible to clean gas efficiently at a low cost in spite of the troublesome problems that have been encountered in the design, maintenance, and operation of this equipment. Many of the weaknesses of these units have been corrected by the simple addition of cooling water, both by volume and by distance of injection ahead of the orifice. This aids in the wetting of the gas and the minimizing of the temperature differences, thus decreasing the abrasiveness of the gas. Great Lakes Steel now has three of its four furnaces equipped with some type of high-energy scrubber and plans on the next reline to install a variable orifice scrubber on the fourth furnace. Future high-temperature operation at 2000 F or more will necessitate the installation of high-energy burners and will create the need for gas cleanliness in the 0.001-grain per scf range. Variable orifice scrubbers approach the level of cleaning gas to the required limits. Only when the maintenance problems are solved will it then become both an efficient and a low-operating cost unit. (Author summary modified)

1890 APTIC NUMBER 20093

Houke, Rae E.
EFFECT OF LOS ANGELES COUNTY AIR POLLUTION CONTROL DISTRICT RULE 66 ON CLEANING AND DEGREASING OPERATIONS. SAE (Soc. Automotive Engrs.) Trans., 76(4):2468-2471, 1968. (Paper 670815.)

Rule 66 of the Los Angeles Air Pollution Control District requires control to specified limits of organic solvent vapors emitted to the atmosphere by industrial cleaning and degreasing operations. Among the solvents identified are trichloroethylene, unsaturated ketones, aromatic petroleum solvents, and some esters and higher boiling solvents. Methods of complying with Rule 66 are the use of activated charcoal adsorption equipment, the substitution of an exempt solvent for nonexempt materials, and the use of the alternate cleaning and degreasing systems. With respect to aerospace industries, the first method does not appear economically feasible at the present time. In contrast, substitution of 1,1,1 trichloroethane or perchloroethylene for nonexempt materials would provide an economical means of compliance. A simple substitution of solvent can be accomplished in existing equipment by merely resetting temperature controls. The substitution of an aqueous cleaning system would be suitable for general cleaning but not for parts that are to undergo coating or further surface treatment. Such systems are more expensive to install and operate than vapor degreasing systems.

1891 APTIC NUMBER 20153

Houry, E. and H. W. Kain
PRINCIPLES OF DESIGN OF SMOKELESS-ODORLESS INCINERATORS FOR MAXIMUM PERFORMANCE. American Gas Association Labs., Cleveland, Ohio, Research Bull. 93, 41p., Dec. 1962. 4 refs.

A study was conducted to reduce the quantity of particulate matter in the effluents of incinerators for domestic waste. The content of the particulate matter was measured in the flue between the primary chamber and the secondary chamber. One end of a steel pipe was inserted into the desired location while the other end extended through the outer jacket of the incinerator and was connected to the glass probe normally used in extracting the effluent sample from the stack. Production of some particulate matter in the primary chambers of present domestic incinerators may be attributed to inadequate heat distribution to the charge and/or insufficient air at the right places in the charge. The input rates of two incinerators were each increased by 10,000 Btu per hour. Particulate matter decreased as much as 87%. Uncarbonized residue remaining in the ash after incineration was reduced as much as 55%. Two domestic incinerators were equipped with power burners. The incineration rate could be greatly increased; an afterburner was not necessary for a satisfactory effluent when a more complete reaction occurred in the primary chamber. A prototype domestic gas-fire incinerator was designed and constructed. The unit operated with a particulate matter content in the flue gases of less than 0.05 grains per cubic foot.

1892 APTIC NUMBER 17644

PROCEDURE FOR THE PURIFICATION OF A GAS WITH SULFUR-CONTENT IMPURITIES. (Werkwijze voor het zuiveren van een gas, dat zwavelhoudende verontreinigingen bevat). Text in Dutch. (Inst. Francais du Petrole des Carburants et Lubrifiants, Paris) Netherlands Pat. 6,613,112. 9p., March 20, 1967. (Appl. Sept. 16, 1966, 6 claims).

A method is proposed for purifying gases with sulfurous impurities, especially hydrogen sulfide, by dissolving the impurities in an organic solvent and converting the dissolved impurities by oxidation into elemental sulfur. The impurities are brought in contact with a polyol monoether which contain 0.1-50% by weight of an alkanolamine or a morpholine. The solution thus obtained is treated with a gas containing molecular oxygen and with a mineral base; the latter is present in quantities amounting to 0.01-10% by weight of the sulfur in the gas to be purified. Treatment with oxygen takes place after the gas has been brought in contact with the alkanolamine solution. Absorption and oxidation can take place simultaneously in the same reaction zone. The organic solvent is regenerated by heating it to 70-200 C, preferably 100-130 deg.

1893 APTIC NUMBER 20148

TRANSPORT AND STORAGE OF NATURAL GASES. J. Fuel Heat Technol., vol. 14:43-44, Jan. 1967.

The contents of three symposium papers (Summer Symposium of the Exploration and Production Group of the Institute of Petroleum) on the technical and economic aspects of transporting and storing natural gas are briefly highlighted. Pipeline transport is 'invisible' but highly capital intensive, while sea transport by tanker requires full development of liquefaction technology. Aquifers and depleted fields offer large, low-cost underground storage capacity, with the former requiring greater capital investment and involving still-unsolved leakage problems; thus aquifers may be used in areas where depleted fields are unavailable. Pipeline storage or surface storage tanks required investments 10 times as large as underground facilities, but complement rather than complete with the latter since they can handle peak loads while underground storage provides for seasonal loads. Volume reduction of 625 to 1 favors storage as a liquid where there is a large volume of natural gas to be stored.

1894 APTIC NUMBER 20225

Jackson, R.
THE PERFORMANCE OF CYCLONES. Brit. Coal Util. Res. Assoc. Monthly Bull., 27(9):413-439, Sept. 1963. 43 refs.

Equations for determining the pressure drop through a cyclone were presented. The expressions agree in making the pressure drop proportional to the square of the inlet velocity of the gas, but differ in the form of the proportionality constant which is a function of the shape of the cyclone. The expressions differ in accuracy, but even the best may yield estimates differing by a factor of two from the observed values. The performance of a given cyclone is defined by the grade efficiency, which is independent of the material being collected. The mass efficiency is the percentage of a given material that is collected and cannot be used for comparison of different cyclones unless it is known that the same material is used throughout. The shapes of the grade efficiency curves differ for cyclones of different proportions and cannot be predicted theoretically. For cyclones of given proportions, the effects of changing their size, the gas throughout, and the characteristics of the gas and particles can be readily estimated. The concept of a cut size, which is the theoretical minimum particle size that can be collected, was used in calculations based on simplified flow patterns to afford a comparison between cyclones of different proportions. Because the flow patterns are more complicated in practice, no such cut size is found and the calculations serve only as rough guides. A number of grade efficiency curves for cyclones of different designs were given in terms of free falling velocity and particle size. An equation showed how to determine mass efficiency from the grade efficiency curve together with a known size distribution of particles. The effects on cyclone performance of changes in dust concentration and wall roughness were discussed. It appeared that an increase in dust concentration decreases the pressure drop and increases the efficiency, whereas an increase in wall roughness significantly decreases both. (Author summary modified)

1895 APTIC NUMBER 20210

Jara, Vladimir, Rostislav Klimecek, Evzen Kordik, and Jan Bettelheim
METHOD OF RECOVERY OF SULFUR DIOXIDE FROM FLUE GAS . Zpusob

ziskavani kyslicniku siriciteho z kourovych plynu). Text in Czech. (Assignee not given.) Czech. Pat. 99,875. 5p., June 15, 1961. (Appl. Sept. 3, 1959, claims not given).

A method is described of recovering sulfur dioxide from flue gases by absorption of SO2 in an aqueous solution of ammonium sulfite; flue gases are cooled by washing with mineral oil and the heated oil is mixed with the saturated absorption solution with regenerates the oil and liberates SO2. The proposed method is more economical than the currently used cyclical ammonia process because the steam used in the old process for the regeneration of the absorption solution is replaced by heat recovered from flue gases by cooling with mineral oil before the absorption of SO2. Flue gas leaving the electrostatic separator for fly ash at a temperature of 150 C passes through a cooling installation where it is washed by 70 C mineral oil. The gas cooled to 90 C leaves the absorption solution deprived of most SO2 and is discharged into the atmosphere. The absorption solution is mixed with mineral oil heated to 120 C, whereby the temperature of the solution is raised to 70 C. Under conditions of underpressure, SO2 is recovered from the solution and further processed into 100% liquid SO2. The mineral oil is separated from the absorption solution in the same installation and returned into the process. Some fly ash also captured by the absorption solution is removed periodically by filtration. The mineral oil used has a flash point above 150 C, is insoluble in aqueous solutions of SO2 and NH3, has a viscosity permitting its pumping above 20 C, and forms emulsions which can be easily separated.

1896 APTIC NUMBER 17808

Jaros, Stanislav, Josef Krizek, and Jiri Sebek
UTILIZATION OF TIED NITROGEN DURING CATALYTIC REDUCTION OF NITROGEN OXIDE. (Zpusob vyuziti vazaneho dusiku pri katalyticke redukci kyslicniku dusiku). Text in Czech. (Assignee not given.) Czech. Pat. 124669. 2p., Oct. 15, 1967. (Appl. April 15, 1967, 2 claims).

Nitrogen oxide is catalytically reduced to remove it from exhaust gases. The degree of reduction is related to the consuemption of hydrogen. The amount of hydrogen is in any case great; this may be done only with simultaneous production of ammonia. The exhaust gases are mixed with the gas containing hydrogen in some form stoichiometerically in excess of 20%. The gas is led to catalyst, the temperature of which is held constant in between 400 to 600 C. The ammonia is gained from the cooled gases.

1897 APTIC NUMBER 20035

Johnstone, H. F.
THE ELIMINATION OF SULPHUR COMPOUNDS FROM BOILER FURNACE GASES. PART I. Steam Eng., 1932:153-154, Jan. 1932. 5 refs. PART II. Ibid, 1932:208-211, Feb. 1932. 1 ref. (Presented at the Third International Conference on Bituminous Coal at the Carnegie Institute of Technology, Pittsburgh, Pa., Nov. 1931.)

Methods for removing sulfur dioxide from flue gases are reviewed with particular attention to scrubbing in the presence of a cayalyst; promising results with iron and manganese compounds are reported. Experiments were conducted with 0.325% SO2 in air bubbled through 2 liters of water and a cayalyst at a rate of 0.7 cu ft/min; contact time was no more than 4 sec. Inhibitory effects of phenols, salts of copper and tin, and hydrogen sulfide in concentrations of more then 0.2% in the gas were noted. Additional studies were made to determine the effects of catalyst concentration, temperature, and presence of inhibitors on scrubber efficiency; in this case, contact time was reduced to 3 sec. The iron catalyst was found to be less affected by inhibitors than manganese. A 100 cu ft pilot scrubber was operated with an initial SO2 concentration of 0.1% and a contact time of 0.05 sec; 270 gal of water per ton of coal were required.

1898 APTIC NUMBER 17902

Kalaushin, A. Ye., L. S. Leont'eva, A. Kh. Frumkina, and D. T. Kas'yan
RENDERING SULFUR OXIDE EXHAUST HARMLESS IN A FOAMY REGIME. (Obesvrezhivaniye otkhodyashchikh sernistykh gazov pri pennom rezhime). Text in Russian. Neftepererab. Neftekhim., no. 9:30-32, 1967. 6 refs.

An arrangement which utilizes alkaline residues derived from leaching kerosene distillate as an absorbing agent for removing sulfur dioxide and sulfur trioxide in a foamy regime is described. Linear flow rate of the gas is 0.6-0.7 m/sec; the gas is not predried and the absorbent is not preheated. Variation in gas temperature from 20 to 36 C had no significant effect on process efficiency which gave 95.3-99% absorption of SO2 and 82.4-99.6% absorption of SO3 with starting concentrations of 0.190-1.003% SO2 and 1.830-0.012% SO3. This process yields a mixture of water-insoluble napthenic acids.

1899 APTIC NUMBER 17824

Kane, J. M. and R. V. Sloan
FUME CONTROL-ELECTRIC MELTING FURNACES. Am. Foundryman, 18(11):33-35, Nov. 1950.

A three-ton, side-charged acid furnace in a steel foundry was tested which operated on a two-hour cycle with charges of approximately 7500 lb. Test No. 2 used heavily oxidized scrap from the bottom of the scrap pile and represents the heavier loadings that could be expected under poorer scrap conditions. The furnace was equipped with hood exhausting fumes from charging door and around electrodes. The pouring spout was plugged so that no escapement occurred at this point. Essential data from four tests conducted during four complete 2-hr melting cycles are tabulated. Dust loading in exhaust gases varied with the point in the melting cycle, with the heaviest loading occurring during the boil and refining cycle. Variation in loadings of the four tests are shown. Samples taken periodically during the test runs were checked with the electron microscope, and it was indicated that approximately 95% of all particles, were less than 0.5 micron, with practically no particles above 2 microns. Agglomerating tendency of the material was pronounced. A local exhaust wet type dust collector was installed for the two furnaces which guaranteed to meet solids removal requirements. Test data

during a 97-min period, including the boil and refining periods of both furnaces, indicated a loss from the exhaust system discharge of 3.35 lb/hr as compared with an allowable 8.39 lb/hr. From this study, emission of solids of the order of 5 to 8 lb/hr/ton of metal melted can be expected from electric melting furnaces in steel foundries. Reduction of this quantity by about 75% can be obtained with wet dust collection equipment.

1900 APTIC NUMBER 17981

Kartsynel', M. B. and A. I. Chernikov.
ADSORPTION OF SULFUR DIOXIDE ONTO CHROME-TIN CATALYST. (Adsorbtsiya sernistogo gaza na khromooloviyannom katalizatore). Text in Russian. Tr. Dnespropetr. Khim. Tekchnol. Inst., no. 6:66-71, 1958. 5 refs.

Experimental data concerning the adsorption of sulfur dioxide onto a chrome-tin catalyst agreed with both the Freundlich isotherm and the Langmuir isotherm at temperatures of 34.9, 42.4, and 100.7 C. The quantity of adsorbed gas under repeated adsorption at 100.7 C was very small compared to initial adsorption, indicating that the catalyst was initially activated. These findings are in contradiction to those of earlier authors.

1901 APTIC NUMBER 18173

Kaupert, W.
RUBBISH GASIFICATION. EXPERIENCES WITH THE RUBBISH GAS PLANT IN THE DANISH TOWN OF KOLDING. (Muellvergasung Erfahrungen mit dem Muellgaswerk in der daenischen Stadt Kolding.) Text in German. Brennstoff-Waerme-Kraft, 20(9):433-435, Sept. 1968.

A detailed description and diagram are given of a rubbish gas plant in which rubbish is broken down mechanically to fist-size pieces, is fed from above into a 14 m-high vertical oil or gas-fired retort and is gasified at a constant temperature of 1000 C. The fuel oil consumption is 0.18 tons per ton of rubbish. The combustion gases travel through annular channels in the retort wall and through a heat exchanger in which they are cooled to 170 C and escape through a short tin flue without noticeable smoke emission. A patented 'heat muff' on top of the retort provides a heat-proof seal and removes the produced gas, mixed with steam added in the required proportion to a cooler in which the gas-steam mixture is cooled to 70 C. The heat content of the gas and the heat of condensation of the steam are used for heating. The condensate is alkaline and does not attack plant surfaces. The rubbish gas is then scrubbed in the conventional manner and fed into a gas storage tank. The ash, falling down through the bottom outlet of the retort is absolutely steril, fine-grained and very loose and may safely be used as a fill. Other uses are under investigation. The chemical composition of rubbish gas during the year 1967 is given. Its heating value was, on the average, 3290 kcal/normal cu m. A cost estimate of the operation of a rubbish gas plant in towns of different sizes is given.

1902 APTIC NUMBER 17947

King, A. G. and A. S. Murphy
DUST CONTROL AT THE ADAMS MINE. Can. Mining J., 89(10):65-68, Oct. 1968.

Dust at the iron ore mining and crushing operations of Adams Mine contains about 28% free silica and is reduced to 3.3% free silica in the pellet plant; although 200,000 cu ft/min of dust collection capacity was initially installed, problem areas were encountered. Acceptable air conditions were achieved in the shovel cabs by maintaining a slight positive pressure, and a rubber boot was installed over the opening around the transmission housing to control the influx of dusty air into haulage trucks. Roads were sprinkled with water and calcium chloride, and drills were stripped of their trapping devices and installed with water tanks for wet drilling. Floor plates were welded to prevent leakage in the gyratory crusher, and the bag house was insulated to maintain temperatures below freezing. An exhaust duct is proposed around the top of the dumping bay to handle approximately 100,000 cu ft/min of air through cyclones. In the secondary and tertiary crushing and screening plant, joints were welded to prevent leakage, unusually dusty areas isolated, and more exhaust systems installed. A large table top plenum, air conditioner, and fan were installed in the concentrator laboratory, while a larger exhaust and air heater were needed in the welding shops.

1903 APTIC NUMBER 18187

Kolm, Ernest L., and William J. Darmstadt
APPARATUS FOR RECOVERY OF HEAT AND CHEMICALS. (Babcock and Wilcox Co., New York, N. Y.), U. S. Pat. 3,284,064. 4p., Nov. 8, 1966. 5 refs. (Appl. March 28, 1963, 2 claims.)

Apparatus for the recovery of heat and solids from a hot gas laden with entrained dust particles of chemical fumes is proposed. The principal object of the equipment is to maintain high dust removal efficiency over a range of gas flow rates. In accordance with this invention it was found that the collection efficiency of venturi-scrubber aparatus could be maintained at reduced gas flow rate by reducing the cross-sectional flow area generally in correspondence with reduction in flow. The means for adjusting the cross-sectional flow area within the scrubber could be positioned within the flow path centered along the longitudinal axis of the gas flow path. Such a location was free from any tendency for the deposition of solid on the adjusting device when the liquor spray nozzles were positioned upstream of the adjustable flow area reducer. Diagrams show the construction of a venturi scrubber-cyclone, a cross-section of the throat portion of the scrubber, and a sectional view of the adjustable vane, all in accordance with the invention.

1904 APTIC NUMBER 20108

Kotera, Yoshihide
HYDRODESULFURIZATION OF FUEL OIL. (Juyu no chokusetsu datsuryu - ryudosho hoshiki). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 49)516):197-205, April 1970. 9 refs.

The hydrodesulfurization of fuel oil is examined, and the minor component in fuel oil is tabulated. Engineering problems

associated with the 'H-Oil' desulfurization process, performed in a fluidized bed, are described in detail. Hydrodesulfurization studies carried out by the Chemical Industrial Research Institute in Tokyo are discussed with respect to both engineering problems and the choice of catalysts. Data is presented for a 'moving bed' type of process that is expected to be useful in commercial plants. The catalyst employed in this process is Co-Mo-Al2O3, the properties and methods of preparation of which are reviewed.

1905 APTIC NUMBER 20211

Krejcar Emil
REMOVAL OF SULFUR DIOXIDE FROM INDUSTRIAL EMISSIONS. (Odstranovani Kysliciniku Siriciteho z prumyslovych exhalaci). Text in Czech. (Abstract not given.) Czech. Pat. 107,940. 2p., July 15, 1968. (Appl. Jan. 16, 1962, claims not given).

A method is described for removing sulfur dioxide from industrial emissions by means of quaternary ammonium styrene-divinylbenzene, strongly alkaline anion exchange resins, or by means of sodium alkaline anion exchange resins prepared by the polycondensation of epichlorhydrine and of polyamines. The invention is an improvement over a previous method which uses slow velocities, a great surplus of water, and does not remove the acid component completely. the proposed method removes SO2 from even highly diluted mixtures and at linear velocities up to 1 m/sec in a column filled with the ion exchange resin with the gas entering the column either from the top or from the bottom. Regeneration by a solution of ammonia or of ammonium chloride yields a solution of ammonium sulfite which can be used as such or processed into concentrated SO2. The ion exchange resin regenerates to its original form and is capable of further absorption; the process can be repeated infinitely. The absorption capacity of a copolymer of styrene and 8% divinylbenzene with quaternary ammonium groups is 80 g SO2/l ion exchange resin. Regeneration is accomplished by 30% NH4Cl solution of a volume equal to that of the ion exchange resin with a resulting 15% eluate of ammonium sulfite.

1906 APTIC NUMBER 20252

Kridner, Ken
WHAT ARE INDUSTRY NEEDS FOR GAS STORAGE? Pipe Line Ind., vol. 23:28-30, Oct. 1965.

The problem of balancing natural gas production against customer demand with the attendant need for storage is reviewed; LNG (liquefied natural gas) storage is emphasized. Natural gas, produced principally in the five state area of Texas, Louisiana, Oklahoma, Kansas, and New Mexico finds its greatest area of consumption in the populated regions of the Northeast and Pacific coast. Growth of the gas industry over the past ten years can be traced directly with development of underground storage fields. Liquefied natural gas occupies one six-hundredth of the space occupied by vaporized natural gas. Results of studies seeking an answer to meet local peak shaving needs has prompted an interest in LNG.

1907 APTIC NUMBER 20135

Kummer, Joseph T. and Neill Weber
A SODIUM-SULFUR SECONDARY BATTERY. SAE (Soc. Automotive Engrs.) Trans., 76(2):1003-1007, 1023-1028, 1968. 2 refs. (Paper 670179.)

The sodium-sulfur secondary battery shows promise as a power source for electric vehicles by virtue of superior energy and power densities and use of inexpensive, light reactants. The cell is a sealed low pressure device operating at 300 C, in which liquid reactants are separated by a novel solid ceramic electrolyte permeable only to sodium ions. Under proper conditions, the sodium-sulfur reaction is electrochemically reversible; both are molten at 115 C, and if sodium is added to a fixed amount of sulfur, a high specific energy can be obtained before the melting point of the reaction product exceeds 300 C. Both sodium and sulfur are readily available and inexpensive and can be contained at 300 C in vessels made of common materials, such as stainless steel and aluminum; the highest pressure encountered is the vapor pressure of pure sulfur, about 60 mm Hg at 300 C. Beta-alumina, an ionically conducting solid electrolyte around which most of the research centered, is a layer structure in which sodium ions are found in relatively open planes together with bridging oxygen ions that have the effect of providing a spacing which results in nearly optimum mobility for a monovalent ion the size of sodium. The battery is inoperable at room temperature, so a cold start is impossible unless auxiliary heating is used.

1908 APTIC NUMBER 20053

Kurkin, V. P.
EFFECT OF AIR PERMEABILITY OF FABRIC ON ITS FILTERING POWER. (Vliyaniye vozdukhopronitsayemosti takani na yeye fil 'troval 'nyyu sposobnost'). Text in Russian. Tekstil. Prom. no. 1:55-57, 1968.

Air permeability is defined as the ratio of specific gas flow rate to the hydraulic resistance of the fabric. This parameter was used as a criterion of filtering power in tests of 14 different fabrics considered for use as industrial gas filters. Fabrics which gave the most effective dust removal exhibited less than optimum air permeability. This is explained by the fact that streamlines come closer to the fabric surface, thus facilitating adhesion of suspended particles to the threads. Material with a teased surface and an air permeability of 2.4 cu m/min kg is recommended for use in filters.

1909 APTIC NUMBER 20223

Lemke, Kurt
PROCEDURE AND MECHANISM TO REDUCE THE PYRITE CONTENT OF COALS FOR THE PURPOSE OF REDUCING THE SULFUR OXIDE CONTENT OF EXHAUST GASES. (Verfahren und Vorrichtung zur Herabsetzung des Pyritgehaltes von Kohle zwecks Verringerung des Schwefeloxydgehaltes von Rauchgasen). (Bergwerksverband G. m. b. H., Essen, W. Germany) W. German Pat. 1,247,981. 3p., Aug. 24, 1967. 5 refs. (Appl. Dec. 12, 1964,

6 claims). Translated from German. Franklin Inst. Research Labs. Philadelphia, Pa., Science Info. Services, 7p., Aug. 10, 1969.

A process is described for the economic removal of pyrite from the finest fractions of coal or pyrite-enriched coal dust. It is based on the disintegration of coal into a light and essentially pyrite-free component and a heavy pyrite-enriched component, followed by the dry separation of the latter component according to its density. In the separation process, thin layers of coal dust are uniformly distributed across the entire width of a vibrator-sluice and guided over it. The sluice comprises a series of vibrating troughs which become successively more narrow and deep. In the course of its path over the troughs, the coal-pyrite mixture spreads out into particles having the same size but varying in weight according to their densities. The pyrite components are collected in end plates attached to the troughs; coal dust is passing over the plates. The collected pyrite is removed by an optically controlled throughput device which operates discontinuously, while the desulfurized coal components are again combined with the light components. The collected dust is used for coal-dust firing. The process has applications both for the treatment of coking dust and the desulfurization of fuel dust for coal firing.

1910 APTIC NUMBER 20785

Lenane, Denis L. and Raymond G. Lyben
EXHAUST TREATING DEVICE. (Ethyl Corp., New York) U. S. Pat. 3,485,593. 5p., Dec. 23, 1969. 11 refs. (Appl. June 9, 1967, 17 claims).

A means of removing particulates from the exhaust gas of internal combustion engines is presented; which extends the useful life of an oxidation catalyst in a catalytic muffler. The exhaust gas is first passed through a louvered agglomeration unit, where the particles accumulate and increase in size, and then to a cyclone separator, the efficiency of which is increased by the agglomeration of particles. To reduce the unburned hydrocarbon and carbon monoxide content of the low-particulate exhaust gas, the gas is contacted with an oxidation catalyst in the presence of oxygen. A preferred catalyst is an alumina impregnated with copper oxide and palladium. Because the particulates have been removed, the catalyst bed does not become plugged or deactivated.

1911 APTIC NUMBER 17807

Klimecok, Rostislav and Vladimir Jara
WAY OF ABSORBING SULFUR DIOXIDE FROM EXHAUST INDUSTRIAL GASES. (Zpusob absorpce kyslicniku siriciteho z prumyslovych plynu). Text in Czech. (Assignee not given.) Czech. Pat. 106829. 2p., (Appl. Sept. 15, 1962, 2 claims).

Sulphur dioxide is absorbed from exhaust gases in a suspension of zinc compounds, but soluble compounds of sodium, potassium or ammonia (or their hydroxides) are added to the absorption liquid. This addition increases the absorption capacity of the liquid, the absorption rate, and yield. The amount of additives is chosen according to further processing of the absorption product (usually .5-50g/liter of absorbing liquid) and they can be introduced into the system in several ways. An example of industrial application is presented. Exhaust gases with 6% SO2 are wetted by a water suspension of zinc hydroxide; 5-10g of ammonia (or NaOH or KOH) are added per liter of absorption liquid. When the wetting rate is approximately 10 cu m/sq m ft per hour, the absorption yield is 80-90%. With zinc suspension only, the yield is 70-80%. Similar result without using additives would be obtained by economically disadvantageous increased intensity of wetting.

1912 APTIC NUMBER 20056

Little, A. and B. W. Sutton
INDUSTRIAL AIR CLEANERS A STUDY OF COST AND EFFICIENCY. Filtration Separation, (Purley), 1967:109-116, March-April 1967. 7 refs.

In the chemical industry, air-cleaners are used for two main purposes: 'air-conditioning', such as simple filtration in the office ventilating system or the more elaborate air-cleaning systems used in laboratories and plants and the much more exacting 'process-air cleaning'. A chart of particle-size ranges, plotted on a logarithmic scale, of airborne dust, solid, and liquid aerosols and other small particles, indicating the usual methods of size measurements as well as the methods of separation of particles from gas is given. Cumulative particle-size distributions of typical airborne dust and of sodium-chloride, methylene-blue and ICI radioactive aerosols are shown. Brief descriptions of 8 common types of air cleaners with comments on practical operating problems include the 'oil-leaf' filter, automatically cleaned 'roller-blind' filter, non-shaking bag filter, irrigated-target (Peabody) scrubber, ceramic candle filter, electrostatic precipitator, permanent cell with replaceable pleated filter fabric or paper, and the glass-fiber paper filter. The physical processes underlying air cleaning by filter media and by two-stage electrostatic precipitators are explained. An apparatus for testing filter media using a radioactive test aerosol, (an atomized dilute aqueous solution (0.01% w/w) of potassium dihydrogen phosphate 'labeled' with about 0.4 microcuries per ml of phosphorus 32 P(32), which is a beta-ray emitter), is described.

1913 APTIC NUMBER 20228

Lundberg, A. H.
SULFUR DIOXIDE RECOVERY. Paper Trade J., 131(22):147-151, Nov. 30, 1950. 11 refs.

The fundamentals of gas absorption in the process of recovering sulfur dioxide to prepare sulfite pulping cooking acid are reviewed. The solubility of the gas in a liquid is determined by the temperature of the liquid and the partial pressure of the gas over the surface of the liquid. The solubility increases with an increase in the partial pressure and decreases with an increase in the temperature of the liquid. At a constant temperature, the rate of change of solubility with partial pressure is sometimes a linear relationship that follows Henry's law. In the case of a water solution of sulfur dioxide, total pressure is the sum of the partial pressure of sulfur dioxide and partial pressure of water vapor over the solution. When sulfur dioxide is dissolved in

water which contains a base, it reacts with the base to form a water solution of the bisulfite. This allows an increased solubility of total sulfur dioxide over that for pure water at the same temperature and partial pressure, except at temperatures below 20 C. Nearly complete recovery of sulfur dioxide is obtained by using low pressure accumulators in conjunction with absorption towers in which the weak gas is passed countercurrent to a spray of water.

1914 APTIC NUMBER 20217

Malyuta, D. I., N. M. Seitim, I. I. Afanas'ev, I. N. Logachev, V. V. Kachanov
COMBATING DUST IN THE RECOVERY LOOP OF SINTERING PLANTS. (Bor'ba s pyl'yu na trakte vozvrata aglofabrik). Text in Russian. Metallurg., 12(9):11, Sept. 1967.

Double-wall aspiration hoods of new design, featuring more efficient air exchange and improved hermetic sealing, are described. These coverings function under a negative pressure of 0.6-0.8 kg/sq m with an aspiration rate of 3000-4000 cu m/hr. They handle a chute discharge of 80-100 t/hr at temperatures of 80-150 C. Improved single-wall hoods for chute feeders are also described. These operate at a negative pressure of 0.4-0.6 kg/sq m with an aspiration rate of 2100-3000 cu m/hr and handle material at 250-350 C. These hoods have operated successfully for four months under plant conditions.

1915 APTIC NUMBER 17814

Marchejuet, Henri-Georjes-Louis and Louis Gandon
PROCEDURE FOR EXTRACTING SULFUR DIOXIDE FROM GASES CONTAINING IT. (Procede d'extraction d'anhydride sulfureux a partir de gaz qui en renferment). Text in French. (Societe Nobel-Bozel, Paris (France)) French Pat. 1,224,892. 4p., June 28, 1960. (Appl. Feb. 2, 1959, 3 claims).

A gas mixture containing sulfur dioxide is brought in contact with a glyoxal solution at a temperature below 50 deg, in such a way as to retain the sulfur dioxide in the form of a glyoxal compound. The solution is then heated to a temperature above 50 deg, liberating the sulfur dioxide in the form of a nearly pure sulfurous gas. One may use an aqueous solution of glyoxal, containing 1-60% by weight of glyoxal; the optimum concentration is in the range of 10-30% and preferably 20%. The gas containing sulfur dioxide may also contain one or more of the following: air, hydrogen chloride gas, or hydrocarbons. The best operating temperature range for retaining the gas is 15-30 deg. The best regenerating temperature range is 65-75 deg. The regeneration process must be halted before the glyoxal is completely deprived of SO2.

1916 APTIC NUMBER 20098

Margraf, Adolf
FILTERS FOR PURIFYING WASTE GASES ORIGINATING FROM ALUMINUM REMELT FURNACES AND THEIR CONVERTERS. (Filter zur Reinigung von Abgasen aus Aluminum-Umschmelzoefen und zugehoerigen Konvertern). Text in German. Wasser Luft Betrieb, 14(3):97-101, March 1970.

The purification of waste gases from aluminum remelt furnaces and their converters is connected with special problems. Investigations are being conducted to solve these problems by means of wet methods, electric filters, or filter-type dust extractors. The use and the result of a combination of a cooler and a filter-type dust extractor are discussed with respect to design criteria. A chemical breakdown of the filtered dust included 44.3% sodium chloride; 21.4% potassium chloride; 25.9% silicon dioxide; 1.9% calcium chloride; 2.0% magnesium chloride; 0.6% aluminum trioxide; and 0.7% iron oxide.

1917 APTIC NUMBER 20091

Marks, Craig, Edward A. Rishavy, and Floyd A. Wyczalek
ELECTROVAN-A FUEL CELL POWERED VEHICLE. SAE (Soc. Automotive Engrs.) Trans., 76(2):992-1002, 1023-1028, 1968. 4 refs. (Paper 670176.)

As part of an overall evaluation of the problems and potential of electric-powered vehicles, a hydrogen-oxygen fuel cell system and an experimental motor drive were developed to power a small van. The fuel cell system is the source of all power supplied to the van, including the power for the drive motor, all auxiliary motors, the safety monitoring circuits, and the standard 12V piston. The system consists of 32 modules, each weighing 42 lb dry, connected in a series to produce an open circuit voltage of 520 V. The system is rated at 32 kW for continuous operation but is capable of 160 kw for short periods. The cells are installed under the floor and symmetrically located about the centerline of the van. The system is automatically monitored for temperatures, fluid pressure, and liquid levels. Temperature is maintained by circulating the electrolyte (aqueous potassium hydroxide) through a heat exchanger. All fuel energy is tranformed into electricity or into heat; very little is discharged into the exhaust product water. The motor control system inverts the d-c power of the cells to a-c power for the induction motor. While road tests verified the thermal efficiency of the fuel cells, many problems remain to be solved before fuel cell power plants are suitable for vehicle application.

1918 APTIC NUMBER 20251

Martin, D. A. and F. E. Brantley
SELECTIVE ADSORPTION AND RECOVERY OF SULFUR DIOXIDE FROM INDUSTRIAL GASES BY USING SYNTHETIC ZEOLITES. Bureau of Mines, Washington, D. C., Rept. of Investigations 6321, 15p., 1963. 11 refs.

Five types of molecular sieves containing synthetic zeolites, used in adsorbing sulfur dioxide from a mixture of gases, were tested for their adsorbing, regenerating, multiple loading, and sulfur recovery capacities, using sulfur dioxide gas generated from the decomposition of gypsum. Three of the sieves (with manufacturer's designations of 4A, AW500, and 13X) demonstrated a capacity for adsorbing sulfur dioxide up to 29 grams per 100 grams of adsorbent, with 90% of the SO2 capable of desorption from the loaded beds, in sufficient purity to permit direct liquefaction. Good results depended, however, on the cooling and drying of the gas stream

before it contacted the adsorbent, and the zeolites lost their adsorptive capacity with repeated use. The most stable types were 4A and AW500. The recommended procedure is to heat the sieves to 375 C and to use nitrogen as a carrier gas in purging the saturated sieves. The experiments demonstrated the technical feasibility of the use of such material, but permit no conclusions as to economic practicality.

1919 APTIC NUMBER 20799

Maurin, P. G. and J. Jonakin
REMOVING SULFUR OXIDES FROM STACKS. Chem. Eng. Deskbook, 77(9):173-180, April 27, 1970. 30 refs.

More than 68 billion pounds of sulfur dioxide will be emitted to the U. S. atmosphere in 1970, 75% of it resulting from the combustion of sulfur-bearing fossil fuels. Switching from high-sulfur to low-sulfur coal or fuel oil is a temporary expedient at best: the demand for these fuels far outstrips available resources. Various dry and wet absorption and adsorption processes, as well as catalytic oxidation, which are being developed and sold here and abroad are discussed. Removal efficiency of each method is noted. Dry injection of pulverized limestone or dolomite removes only 25-35% of sulfur oxides in the furnace. The principal advantage of the alkalized alusina process is the ability to recover marketable sulfur to offset operating costs, but a drawback is the high absorption temperature the requires the system to be located between the economizer and air preheater. In the DAP-Mn process, the gas contacts the injected sorbent (manganese dioxide) and both pass through an entrainment-type absorber, yielding ammonium sulfate as a by-product. For a coal-fired utility, further expenditures for preliminary cleaning of the gas after the air preheater are necessary to maintain absorbent integrity, and emission of manganese compounds could present a health hazard. Hydration of lignite ash converts its high line content to calcium hydroxide, but there have been problems of sulfate fouling the absorbent. In terms of number of processes, wet absorption is by far the most popular system; for both the ammonia and lime techniques, 90% sulfur removals are claimed. Adsorbents afford less loading capability but are simpler to regenerate than absorbents, and several processes, all using carbon, are in varying stages of development. Monsanto's Cat-Ox process is the most advanced catalytic oxidation method for sulfuric acid recovery, and by maintaing proper temperature, 90%-plus conversion can be obtained.

1920 APTIC NUMBER 17980

May, Charles W.
MEMPHIS LNG PLANT NEARS COMPLETION. Am. Gas J., 194(6):35-36, 38, 42, 44 [illegible]5, May 1967.

Gas purification, liquefaction, storage, and regasification facilities of the Memphis Light, Gas and Water Division, scheduled for completion in mid 1967, are described. This plant has a liquefaction capacity of 5 MMcfd, a storage capacity of 300,000 bbl, and a maximum vaporization rate of 200 MMcfd. Purification is accomplished in a three-tower molecular sieve adsorption unit. Liquefaction is by cascade refrigeration using propane, ethylene, and methane as refrigerants. Storage is in a double-wall, above-ground steel storage tank designed for earthquake resistance of a Zone 1 seismic intensity. A full listing of equipment and suppliers is given, as well as the overall flow scheme for the installation.

1921 APTIC NUMBER 17905

McLaughlin, J. F. and J. Jonakin
SO2 TRAPPED IN FULL SCALE SYSTEM. Elec. World, 168(20):108-110, Nov. 13, 1967.

In order to determine the feasibility of removing sulfur dioxide and particulate matter from gases in a wet scrubber, a laboratory pilot plant was constructed and tested. A controlled amount of sulfur dioxide, additive, and fly ash was added to the stack gas of a natural-gas-fired boiler; the mixture was passed through a wet scrubber. The gas was sampled before and after the scrubber to determine the removal efficiency. The results are tabulated. Ninety-eight to 99% sulfur dioxide removal and 98 to 99.6% dust removal were obtained. The next phase of the investigation was conducted to determine whether or not the laboratory pilot data could be confirmed on a commercial size unit. In addition, furnace operating conditions during dolomite injection were studied. In the full-scale tests, dolomite was introduced to one furnace of a 325,000 KW, twin-furnace steam generator. Dolomite was injected in a sufficient quantity to react with all the sulfur dioxide produced when coals containing 2.8 to 3.8% sulfur were burned. The other furance was operated at the same firing rate and with the same fuel but without additive or scrubber. The results of the field tests are given. The data shows that sulfur dioxide removal can be maintained at a very high level (95% or better). Flow charts of the system are presented.

1922 APTIC NUMBER 20050

(Inventor not given.)
METHOD OF RECOVERY OF SULFUR DIOXIDE FROM GASES CONTAINING IT. (Procede de re-cuperation d'anhydride sulfureux des gaz qui en contiennent). Text in French. (Metallgesellschaft A. G., Frankfurt (M. Germany)), French Pat. 771,452. 6p., July 23, 1934. (Appl. April 9, 1934, 3 claims).

A method of recovering sulfur dioxide from a gas treats the gas with a mixture of organic bases, such as aromatic amines, and water, and subsequently heats the reaction mixture. This mixture is characterized by the fact that sustances are added to it, such as oxides, hydroxides, carbonates, or sulfites of alkali metals, ammonium, or magnesium, which are capable of decomposing the sulfates of the organic bases formed in the secondary reactions of the process into free bases and water-soluble sulfates. The gases produced during the process of absorption and/or the SO2 recovered on heating the sulfite solution obtained in the process of absorption, are interacted, in the presence of water, with a substance which is capable of decomposing the sulfates of the organic bases formed during the process of absorption, such as, for example with an oxide hydroxide, carbonate, or acid sulfite of alkali metals, ammonium, magnesium, or with a mixture of such substances. The scrubbing liquids

btained in this manner are used, in order to recover completely both the absorbent and the absorbed substances they contain, to decompose the sulfates of the organic bases formed by the secondary reactions of the process. The applications of the method are illustrated by six detailed examples.

1923 APTIC NUMBER 20048

(Inventor not given.)
PROCEDURE FOR RECOVERY OF SULFUR DIOXIDE FROM GASES WHICH CONTAIN IT. (Procede de recuperation d'anhydride sulfureux des gaz qui en contiennent). Text in French. (Metallgesellschaft A. G., Frankfurt (M. Germany)' French Pat. Addend. 46,137. 6p., Dec. 23, 1935. (Appl. March 4, 1935, 4 claims), addendum to French Pat. 771,452).

A procedure is presented for eliminating sulfur dioxide, from gases which contain it by treating the latter with a mixture of organic bases (for example, aromatic amines) and water and by heating the reaction product according to the main patent. This consists of adding to the system compounds of alkali-earth metals, which are capable of suppressing the undesirable formation of sulfates of the organic bases which are not readily solube in water by precipitating the H2SO4 formed in the secondary reactions in the form of alkali-earth-metal sulfates, already found by diluting the sulfates of the organic bases, and by accelerating the separation of the phases. The residual gas stemming from the absorption operation or the SO2 obtained by heating the sulfite solution stemming from the absorption operation, or both, are reacted in presence of H2O, on compound of an alkai-earth-metal appropriate for fixing the H2SO4 formed in the course of the secondary reactions and to dilute the sulfates of the organic bases formed in the course of absorption operation. In order to recovery completely the absorbed substances and the absorbing agent contained in the washing solutions or suspensions obtained, the latter is added to the absorption mixture employed to fix the H2SO4 or to dilute the sulfates of the organic bases formed in the course of the secondary reactions. Additives are used which are practically or completely free of elementary sulfur, or which are not apt to give rise to the formation of elementary sulfur under the conditions of the reaction, or which possess these two qualities at the same time.

1924 APTIC NUMBER 17965

Mikus, H. J.
BRAZED ALUMINUM HEAT EXCHANGERS FOR LNG PRODUCTION. Gas, 42(12): 56-57, Dec. 1966.

The area of low temperature heat transfer is critical to proper operation of liquefied natural gas plants. In this connection, brazed aluminum heat exchangers, with their plate-fin and extended surface construction, offer approximately 10 times the heat transfer surface area per cu ft of exchanger volume than that obtained with shell and tube construction. In addition, the brazed aluminum exchangers permit up to six different fluids to transfer heat simultaneously within the exchanger. This eliminates the need for multiple shells, valving, supports, and interconnecting piping. The heat exchange surfaces are obtained by stacking alternate layers of corrugated aluminum sheets (i.e., fins) between flat aluminum separator plates. Each layer is closed at the edges with solid aluminum bars. The stack, including the side bars, is bonded by a brazing process to yield an integral rigid structure with a series of fluid-flow passages. Extremely close temperature approaches can be achieved with the brazed aluminum exchangers, thereby reducing the refrigeration service to a minimum.

1925 APTIC NUMBER 20833

Mills, John L.
CONTINUOUS MONITORING. Chem. Eng. 77(9):217-220, April 27, 1970. 3 refs.

The continuous air monitoring system in operation in Los Angeles County is discussed. Initially the system included data on carbon monoxide, nitrogen oxides, sulfur oxides, and ozone, but instruments have been added to measure hydrocarbons and particulates. Each station is also equipped to measure and record wind speed and direction, temperature and relative humidity. The SO2 in the ambient air is absorbed in distilled water in a contact column, and is then oxidized to sulfuric acid by hydrogen peroxide. Conductivity changes are measured and recorded, the increase being proportional to the SO2 in the atmosphere. Ozone is measured by a colorimetric method, and oxides of nitrogen are determined by photometry. In the CO instruments, measurements depend on non-dispersive infrared absorption, while total hydrocarbons in the atmosphere are determined by flame ionization. By passing the sample through activated carbon, hydrocarbons other than methane are removed. In this way, the instrument is used to record both total hydrocarbons and methane. Automatic tape samplers are used for continuous monitoring and measuring of the atmosphere's soiling quality. A telemetering system has been installed to provide readings of pollutant concentrations and meteorological data, as measured continuously at the 12 monitoring stations.

1926 APTIC NUMBER 18169

AIR WASH SYSTEMS HANDLE ODOUR FROM PACKING PLANT. Mod. Power Eng., 63(6):78-79, June 1964.

Five types of treatment were used in combination in a meat packing plant to handle odor problems from the hog plant, the oil refinery, and the acidulation plant. The five systems are: Dilution - mixing large volumes of odor-free air with air requiring dilution; single stage air-wash - all exhaust air is spray-washed with chlorine; two-stage air-wash - the second stage washes the air using clear water that adsorbs the chlorine; submerged-orifice scrubber - the air is washed in a submerged state in chlorinated water; two-stage wetted-fiber air-washing system - provides more intimate contact between chlorinated water and the air. The hog plant utilizes the two-stage air-wash with a chlorine rate of 50 ppm, the refinery unit utilizes the submerged-orifice scrubber with a chlorine rate of 50 to 100 ppm, and the acidulation odors are handled by the two-stage wetted-filer system using a Terylene filter and clear water washing to remove chlorine.

1927 APTIC NUMBER 18152

ASPHALT PLANT BEATS DUST PROBLEMS. Mod. Power Eng., 63(6):76-77, June 1969.

The dust removal system of the Peel Construction Plant is reviewed. The largest source of dust emissions is the rotary drier, and secondary sources include the hot aggregate bucket elevator, the vibrating screens, the mixer, and the aggregate weight hopper. Material caught by the primary dust collector, or cyclone separator, is returned to the hot bucket elevator where it continues with the main bulk of the dried aggregate. The air discharge from the cyclone is ducted to a final wet dust collector consisting of a cylindrical drum equipped with four rows of water spray jets. Dust laden mist then enters the bottom of a 30 ft diameter cylinder that acts as a stack as well as final dust separator. The heavy mist remains on the bottom of the tank and becomes a liquid. The lighter dust mists swirl upward losing the dust particles due to the reduced air velocity and the force of gravity. The particles are removed as sludge and used in areas requiring land fill.

1928 APTIC NUMBER 18158

Moeller, Dade W., and Abraham S. Goldin
ENVIRONMENTAL PROTECTION FOR NUCLEAR APPLICATIONS. J. Sanit. Eng. Div. Am. Soc. Civil Engrs., 95(SA 3):373-385, June 1969. 23 refs.

Nuclear operations producing radioactive wastes and the role of the environmental engineer in assessing contamination are discussed. Special attention is given to three radionuclides discharged into the environment in whole or part: iodine, krypton, and tritium. Fuel processing plants can reduce their potential discharge of iodine by storing fuel elements for 100 days before processing. No techniques have been developed for removing krypton from waste streams or treating tritiated water. Systems for calcining waste solutions or discharging them into stable geological formations are under investigation. Since they reach people more rapidly than discharges into the ground or water, atmospheric discharges demand more urgent action and detailed planning. Among radionuclide applications under development are the use of radioelements for self-containe' power sources, nuclear propulsion, and nuclear explosives. Radioactive materials associated with weapons testing can be utilized in studying particulate contamination in the atmosphere and tracing effluent discharges. The environmental engineer must be given data to translate dose and intake limits into practical release criteria.

1929 APTIC NUMBER 20809

Morse, Kenneth M.
DUST CONTROL PRACTICES IN THE BITUMINOUS COAL MINING INDUSTRY. Am. Ind. Hyg. Assoc. J., 31(2):160-164, March-April 1970. 10 refs.

Dust produced at the face by a cutting machine is a function of the number of bits, the sharpness of the bits, the speed of the bits, the depth of bit penetration and the experience of the machine operator. Yet, adjustments in cutting conditions are limited by bit strength, lack of torque at low-speeds, and possible adverse effects on coal output, that the method of reducing dust generation by wetting the coal face and the cutting site may be more effective. Experimental field tests on a boring-type continuous miner equipped with water sprays between bit blocks on the boring arms revealed a reduction of 78% in the respirable dust. The dust removed by spraying a given volume of water is dependent upon the number of droplets formed, their size, range, and average capture efficiency during motion, all of which are related to droplet size. Droplet size has been shown to have little practical effect on dust removal down through the 20 micron to 2 micron size range. Under the two-split ventilation system, air is coursed over the continuous miner and is returned behind the line brattice directly to the return airways without passing the dust and gas-laden air over the operating equipment. Good design of face ventilation not only requires a knowledge of the aerodynamic principles of air flow in exhaust and supply systems but also the special problems involved in the application of air flow behind a line brattice or is a flexible exhaust tubing. Mechanical filter respirators indicate highly efficient protection if they are properly worn and maintained, while the use of cryogenic breathing apparatus is another innovation in providing clean air to a continuous mining machine operator.

1930 APTIC NUMBER 20151

Morse, William F.
CRYOGENIC STORAGE OF NATURAL GAS. Am. Gas Assoc. Monthly, 42(3): 15-16, July-Aug. 1961.

Various aspects of storing liquefied natural gas in underground pre-stressed concrete tanks are discussed. Underground storage in general offers substantial cost savings over suface metal tanks, and concrete tanks do not suffer from the geological limitations of such underground alternatives as mined caverns and quarries. Other advantages of underground storage are simpler construction, since only a single wall is necessary; reduced insulation requirements; safety and public relations benefits; and smaller buffer zone requirements. Detailed testing of LNG storage in buried concrete tanks will be carried in a 1000-bbl demonstration tank now under construction.

1931 APTIC NUMBER 17467

Morse, William F.
LNG STORAGE IN BURIED PRESTRESSED CONCRETE TANKS. Am. Gas J., vol. 189:32-34, Dec. 1962. 2 refs.

Pilot tanks were built to study the feasibility of storing liquefied natural gas in a buried, single shell prestressed concrete structure. Depending on the circumstances involved in each installation, the wall and roof were made from precast panels, which were sealed by mortar, or by poured-in-place construction. The insulation material placed on the outside wall and roof of a tank was rigid polyurethane sheets, Foamglas, or similar material. A suitable load bearing insulation, such as

Foamglas, was used below the tank. The third major component of each tank was a continuous metal barrier. This consisted of a thin stainless steel or 9% nickel-steel membrane located on the inside at the floor and outside of the concrete on the wall and roof. This barrier served as a positive liquid and gaseous methane barrier. Considering the pressures that the tanks were subjected to as the result of frost lens formation (frost heaving), the materials performed satisfactorily at liquefied natural gas temperatures. Cost estimates for prestressed concrete tanks are presented. They include the basic tank, insulation, sitework, heating coils, and nickel-steel liner. For a tank capacity of 100,000 bbl, the cost per Bbl is $7.50; for a 450,000 bbl capacity, the cost per Bbl is $4.50.

1932 APTIC NUMBER 20065

Musgrove, Peter J. and Alan D. Wilson
POWER WITHOUT POLLUTION. New Scientist, 45(691):457-459, March 5, 1970.

Electrogasdynamic (egd) generators are discussed as a potential source of low-pollution power supply. Small particles of dust, smoke, fog, etc. are charged in a low-voltage region of an egd generator and then transported by a gas stream to a high-voltage region. Work is done on the particles in moving them against the electric field and electricity is generated. The basic egd generator, in which gas expands and works on the charged particles, is analogous to the turbine of a gas turbine engine. If, however, electrical power is supplied to an egd duct, charged particles can be accelerated by the applied electric field and used to compress the gas. The egd 'compressor' and 'turbine' can then be combined with heat source and sink. The corresponding thermodynamic cycle, the Brayton cycle, is identical with that for a gas turbine. If a heat exchanger is interposed between the compressor and turbine, the thermodynamic cycle becomes the Ericsson cycle. It appears feasible with an Ericsson cycle to construct an egd generator with an efficiency exceeding that of conventional steam turbine-based generating equipment. Either nuclear or fossil fuels could be employed as the heat source. Such a unit would have a wide range of applications as a portable power supply for burning oil or gasoline to provide electricity. The noise level would be very low, and with continuous combustion, the exhaust gases would be much cleaner than those from internal combustion engines.

1933 APTIC NUMBER 20795

Nakai, Yoshiyuki and Tetsuya Yokogawa
OPERATION OF LARGE DESULFURIZATION UNITS. Chem. Economy Eng. Rev., 2(5):44-53, May 1970.

Construction and operating data are presented for a 3000 cu Nm/hr pilot plant waste-gas absorber used in conjunction with a hydrogenation desulfurization unit at an oil refinery and for sintering-plant flue gas. The pilot unit consists of concentric multilayer screens. Air and liquid are brought into contact in cross-currents and the waste gas is dispersed through liquid membranes. Since the gas diffuses from the center of the tower to its periphery, the space rate of the gas as it contacts the liquid membranes gradually changes, and the gas-liquid contact is carried out in irregular currents. Efficiency of the unit is more than 90% for absorption of sulfur dioxide. Moreover, the unit is operable over a much wider range of liquid-gas ratios than other absorbers. Sea water, industrial wastewater, underground water, or ammonia water can be used as the absorbent. With ammonia water, the desulfurization rate was more than 99% under experimental conditions. The oil refinery unit is divided into a cooling tower and an absorber. The absorber comprises a screen section, which forms water membranes for gas absorption, the water distributor, and the demister, which prevents the entrainment of water droplets. It is capable of recovering more than 97% sulfur. The sintering plant absorber is divided into three sections, each with a different function. Water membranes are provided in the first section to remove dust and absorb part of the sulfur oxides, while sulfur dioxide is neutralized and absorbed with ammonia water in the next section. Free ammonia is then absorbed by fresh sea water. When the pH of ammonia water is kept above 6.0, outlet concentrations of SO2 are less than 50 ppm.

1934 APTIC NUMBER 20044

Nakai, Y. and T. Yokokawa
THE STUDY OF MULTI PURPOSE GAS ABSORBER BY WET PROCESS. (Ta-mokuteki shisshiki gasu kyushu-sochi no kenkyu). Text in Japanese. Kagaku Kogyo (Tokyo), 18(12):44-51, Dec. 1961.

Two types of apparatus were used for sulfur dioxide absorption: a gas absorber which has a gas distributor connected with seven circle screens; and a cylindrical gas absorber which has multiple screens. Both of these screens were put on thin plates made of fine metal fibers. The net plates formed an extremely thin water membrane to contact the SO2 gas effectively; the screens changed the velocity of the gas within the apparatus to produce efficient contact with a large amount of SO2 gas with the least reduction of gas pressure. The amount of the standard SO2 gas absorbed by the apparatus was 300 cu Nm/hr; the amount of real exhaust gas was 4200 cu Nm/hr; the absorption ratio of the latter gas was 85%. When ammoniac solution was used, the absorption ratio of SO2 gas was higher than 99% using this apparatus.

1935 APTIC NUMBER 20123

Newhall, Henry K.
CONTROL OF NITROGEN OXIDES BY EXHAUST RECIRCULATION. A PRELIMINARY THEORETICAL STUDY. SAE (Soc. Automotive Engrs.) Trans., 76(3):1820-1836, 1968. 20 refs. (Paper 670495.)

The influence of exhaust recirculation on nitric oxide emissions was evaluated through digital computer simulation of engine cycle. The thermodynamic cycle employed was the Otto cycle, where the initial mixture of fuel, air, and recycled exhaust gas is compressed adiabatically and reversibly. The effects of air-fuel ratio, recycle temperature, and compression ratio on the effectiveness of exhaust recirculation were considered. The influence of air-fuel ratio was clearly demonstrated. In the region between 1.00 equivalence ratio (chemically correct) and 1.10 equivalence ratio (10% rich), recycling effectiveness increased rapidly with increasing mixture enrichment. The

influence of recycle temperature on nitric oxide reduction was minimal, amounting to a decrease in effectiveness of about 10% for a 500 F temperature increase. Compression ratios had relatively little influence on recycle effectiveness. Since dilution of fuel-air mixtures of inert or combustible substances reduces combustion temperatures, the study shows that the influence of combustion temperature on nitric oxide reduction is explained on the basis of chemical equilibrium conditions. Thus, preliminary proof is provided that the recycle technique operates through a shift in the chemical equilibrium species distribution.

1936 APTIC NUMBER 20116

Ninomiya, J. S., A. Golovoy, and S. S. Labana
EFFECT OF METHANOL ON EXHAUST COMPOSITION OF A FUEL CONTAINING TOLUENE, N-HEPTANE, AND ISOOCTANE. J. Air Pollution Control Assoc., 20(5):314-317, May 1970. 21 refs.

Variations in the chemical composition of the exhausts from a single cylinder engine are observed when up to 25% methanol is added to a fuel blend of toluene, isooctane, and n-heptane. Under fuel-rich conditions, and with increasing methanol concentration, unburned fuel and benzene emissions increase, exhaust acetylene remains constant, and propylene, isobutylene, methane, ethylbenzene, and styrene concentrations decrease. As oxygen becomes more available, the effects of methanol are reduced, and at an equivalence ratio of 1.25 (excess oxygen now is present), methanol no longer affects the concentration of exhaust hydrocarbons. These observations are explained by the reactions of formaldehyde, an incomplete combustion product of methanol, with alkyl radicals derived from the fuel. The photochemical reactivity of the exhaust is unchanged when up to 15% of methanol is present in the fuel at an equivalence ratio of 0.85, but increases at higher methanol contents because of the increase in unburned toluene in the exhaust. (Author abstract)

1937 APTIC NUMBER 20860

Noland, Richard D.
TRAVELING PURGE HEAD DUST FILTER. (Air-O-Matics, Inc. Kansas City, Mo.) U. S. Pat. 3,482,378. 6p., Dec. 9, 1969. 13 refs. (Appl. May 15, 1968, 7 claims).

Filter bags of a multiple bag air filter are sequentially cleaned through periodic individual reverse flow by means of a traveling purge head continuously communicating into a stationary pressure duct. This communication is achieved through slidable engagement with a pair of flexible strips mounted on walls of the duct and having portions thereof normally extending into engagement with each other. The purge head locally separates the flexible strips near the bag being subjected to the reverse flow; the strips automatically close the pressure duct in other positions. A multiplicity of valves, associated controls, and flexible hoses are not required, making the equipment simple and inexpensive in construction. (Author abstract modified)

1938 APTIC NUMBER 20243

Oberhaeuser, Alfred and Wolfgang Benarndt
FIRING BOILERS WITH BLAST FURNACE GAS HAVING BEEN ROUGH-CLEANED IN THE DUST CATCHER AND CYCLONE. (Verbrennen von in Staubsack und Wirbler Vorgereinigtem Gichtgas in Kesselhause). Text in German. Stahl Eisen, 87(10):611-617, May 1967. (Presented at a meeting of the Arbeitsausschusses des Hochofenausschusses, Gross Ilsede, May 20, 1966.)

Since 1955, two boilers have been in operation in a power plant attached to a blast furnace in Ilsede which are operated with coal and cleaned waste gas from the blast furnace. A melting pot is ahead of the combustion chamber where one third of the coal and the ash stemming from the coal incineration are molten. Since the boilers were a great success, it was decided to use rough-cleaned waste gas from the blast furnace for the two new boilers which were being constructed. This had the advantage that the gas cleaning system of the plant did not have to be expanded; there was no heat loss; and the water consumption was reduced. The uncleaned waste gas contains 10 g dust/standard cu m. In addition to the gas, coal was fired. The dust separator installed in the path of the uncleaned gas to the boiler rough-cleaned the gas to a residual dust concentration of 1 to 2 g/standard cu m. Dry dust from the uncleaned gas settled in the feed pipe to the boiler. Thus this pipe had to be regularly serviced. Due to the large quantities of flue gas at the combustion of blast furnace gas (45% more than at coal), the boilers have a large combustion chamber. Erosion of the boiler pipes did occur, but could not be traced to the use of the blast furnace gas.

1939 APTIC NUMBER 20844

THE WAR ON POLLUTION. AIR QUALITY CONTROL. QUESTIONS AND ANSWERS. Oil Gas J., 68(24):97-117, June 15, 1970.

The direct and indirect contributions of the petroleum industry to air pollution center largely around the refining operations. Direct contributions, in the form of tank vapors, gas flares, and slush pits, are uneconomical to the refinery and therefore kept to a minimum. Controls in the form of vapor-recovery equipment, salvaging of waste products, and emission controls are extensively used. Indirectly, through fuel production, refineries are responsible for automobile emissions. These emissions are being reduced by employing control devices on the automobile and by changing the composition of the fuel itself. Catalytic and thermal afterburners, thermal-reactor systems and lean-reactor methods of control are discussed, as well as a radical manifold converter which is used to refine lead-free gas. The effect of lead-free gas on performance is described, and possible engine redesigns are considered. The role of tetraethyl lead in increasing octane rating and therfore increasing exhaust emissions is quite significant, and is discussed in depth. Representatives of leading oil companies discuss methods of analysis and air quality standards as they apply to the respective geographical areas.

1940 APTIC NUMBER 15562

Palkot, Edward J., Jr. and C. Judson King
THE DESIGN OF AN IMPROVED DEVICE FOR ABSORPTION WITH CHEMICAL REACTION. California Univ., Berkeley, Lawrence Radiation Lab., AEC Contract W-7405-eng-48, 192p., June 1969. 75 refs.
CFSTI: UCRL-18918

When absorption is accompanied by chemical reaction in the liquid phase, the nature of the gas-liquid equilibrium data is often such that a high degree of gas purification may be accomplished in one or a very few equilibrium stages. Examples of such absorption systems that were considered are the scrubbing of carbon dioxide from gas streams using hot, catalyzed potassium carbonate and the scrubbing of hydrogen chloride from gas streams using water. The scrubbing of CO2 is important in the manufacture of high purity hydrogen for process uses such as the manufacture of ammonia, and HCl absorption is important in many processes, including a scheme for the reprocessing of enriched reactor fuels. Less commonly used devices for carrying out these absorption processes were considered which had features likely to result in high absorption rates and, consequently, high efficiency. The implementation of devices with these characteristics might be expected to result in considerable savings in investment and/or operating costs when compared to equipment currently used to effect the desired gas purifications. The devices considered were the co-current packed column, open pipe contractors with co-current flow of gas and liquid in the froth and annular regimes, and the spray tower. Based on information dealing with these devices in the literature and models which were proposed to fill gaps in the literature, device sizes necessary to scrub gases of quantities and compositions likely to be encountered in industry were calculated. Hierarchies of attractiveness of the devices for each of the systems studied were determined by assigning relevant cost variables to each contractor. It was shown that some of the devices could well be attractive in reducing the costs of absorption in the processes considered. (Author abstract modified)

1941 APTIC NUMBER 20154

Parrish, E. C. and R. W. Schneider
TESTS OF HIGH EFFICIENCY FILTERS AND FILTER INSTALLATIONS AT ORNL. Oak Ridge National Lab. Tenn., Inspection Engineering Dept., AEC Contract W-7405-eng-26, 42p., 1963. 8 refs.
CFSTI: ORNL 3442

High efficiency filters are used in air handling systems as the primary means of minimizing the amount of radioactive matter released to the atmosphere. The feasibility of measuring the filtration efficiency of systems containing such filters was established; since the middle of 1962, the efficiency of more than 650 systems was successfully measured in situ using an aerosol of dioctyl-phthalate (DOP) and a forward light scattering photometer. It is relatively easy to achieve a system efficiency of 99.7% or higher in single and double-filter installations. Relatively few existing, large multifilter installations had a satisfactory efficiency at the time of the test. Only 31% of the systems containing three filters or more had an efficiency of 99.7% or better as compared with 78% of the one-and two-filter installations. Concurrent with in situ tests, 1500 new filters were checked; the average deviation of the measured effiencies was plus or minus 0.003%. Tests of the effect of prolonged exposure to DOP aerosol on the efficiency showed that the high filter efficiency could be maintained by intermittent periods of airflow without aerosol injection. Airflow had little effects on the efficiency of a new filter but significant effect on filters containing defects due to the 'pinhole' effect. Test of the linearity of the NRL type photometer revealed that good linearity was observed over a wide range of aerosol concentrations.

1942 APTIC NUMBER 20078

Priddy, Max H.
MODERN APPROACH TO INDUSTRIAL AIR POLLUTION. Ind. Gas, 50(5):9-14, May 1970. (Presented at the Midwest Industrial Gas Council, Chicago, Ill., Oct. 17, 1969.)

Early in 1967, a joint program was begun by Surface Combustion Division and the Columbia Gas Systems Service Corporation to instigate a complete research and development program in the area of pollution control. A laboratory was built in which the reaction kinetics of many hydrocarbon contaminants could be studied in terms of temperature requirements, reaction rates, and other variables. It is equipped with a blower, preheating temperature control, equipment for rapid mixing of a gas sample with an airstream, and a reaction chamber equipped with temperature and velocity measuring devices and oxidation rate analyzers. With this equipment, the comparative incineration rates of some common hydrocarbons have been determined at 1,410 F. A practical application of the program was the designing of commercial equipment, such as a stack incinerator for use with an exhaust airstream containing at least 15% oxygen; a 'packaged' stack incinerator complete with a fan, a complete line of controls, safety devices, and temperature instrumentation; and an injection incinerator for heavy-duty combustion systems operated at high temperatures.

1943 APTIC NUMBER 20248

Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration
A STATUS REPORT: PROCESS CONTROL ENGINEERING; R & D FOR AIR POLLUTION CONTROL. 37p., Nov. 1969.

The various phases of the work of the Process Control Engineering Division of the National Air Pollution Control Administration are described as of late 1969. These include sulfur oxides control (dry and wet limestone processes, coal cleaning, and new processes such as those employing molten alkali carbonates), industrial process control (nonferrous smelting, iron and steel, sulfuric acid, papermaking, graphic arts, iron foundries, aluminum smelting, etc.), combustion emissions control (e.g., fluidized-bed combustion, nitrogen oxides), applied equipment research (wet scrubbers, fabric filters, electrostatic precipitators, incinerator control), supporting measurements (detection, spectroscopy, dust- and gas-sampling analysis, holographic determinations, continuous monitors, etc.), and advisory and supporting services. A special report is also given on the alkalized alumina process for control of SO2. A list of 110 specific research projects and 11 services is given. More than eleven million dollars was budgeted for the Process Control Engineering programs in 1969. The

1970 budget is expected to be more limited, necessitating an emphasis on sustaining rather than new programs.

1944 APTIC NUMBER 20819

Quintilian, Bartholomew F. and James R. Zarfoss
DISCHARGE ELECTRODE ASSEMBLY FOR ELECTROSTATIC PRECIPITATORS. (Koppers Co., Inc., Monroeville, Pa.) U. S. Pat. 3,483,670. 6p., Dec. 16, 1969. 17 refs. (Appl. Dec. 15, 1967, 2 claims).

Conventional electrostatic precipitators are made up of a number of grounded collecting electrodes and high voltage discharge electrodes in a spaced relationship. Rappers are attached to the electrodes to remove the particles collected on them. The discharge electrodes, however, are more sensitive to rapping, and fatigue and mechanical failure result. A discharge electrode assembly for electrostatic precipitators adapted for vertical suspension from a high voltage support frame is described. The assembly comprises an elongated electrode wire with its opposite ends terminating axially within two identical shrouds. Each shroud is shaped as an elongated rod ending in a frusto-cone and enlarged button head. The wire and shrouds are secured together by a nonlinear multi-sided crimp. This provides stepped or tapering forces on the wire. One of the shrouds sits on the edges of an open keyhole slot in the support frame, with the remainder of the electrode assembly suspended vertically beneath. The other shroud sits on the edges of a transverse slot in a cylindrical weight adapted to receive it. The weight confines the shroud in a central position to provide tensioning and aligning for the electrode assembly. (Author abstract modified)

1945 APTIC NUMBER 17816

Renault, Philippe
PROCEDURE FOR DESULFURIZING AND DECARBONIZING GASES. (Procede de desulfuration et decarbonation des gaz). Text in French. Inst. Francais du Petrole des Carburants et Lubrifients, Paris.) French Pat. 1,463,790. 2p., Nov. 21, 1966. (Appl. Oct. 20, 1964, 2 claims).

Gases containing hydrogen sulfide and sulfur dioxide are reacted with a solution of sulfur dioxide in dimethyl sulfoxide in a process to desulfurize and decarbonize gases. The operating temperature should be between 20 and 80 C, and preferably 30-60. The dimethyl sulfoxide should contain preferably about 40% by weight of water. These conditions permit a rapid, immediate reaction between H2S and SO2 to yield elemental sulfur.

1946 APTIC NUMBER 18197

Riese, Wilhelm
THE USE OF ACTIVATED COAL FOR THE REMOVAL OF SMALL CONCENTRATIONS OF NITROGEN OXIDES FROM GASES. (Ueber die Brauchbarkeit von Aktivkohle fuer die Entfernung geringer Gehalte von Oxyden des Stickstoffs aus Gasen.) Text in German. Brennstoff-Chem. (Essen), 21(3):25-16, Feb. 1, 1940. 7 refs.

Laboratory experiments with 200 cm and 100 liters activated coal showed that it is chemically, technically, and economically feasible to use it for the removal of nitrogen oxides from waste gases of a coking plant. The waste gas develops in a thermal cracking process during which water vapor is added. The gas is subsequently washed under pressure with water and lye. It is low in, but not free of, tar-forming hydrocarbons. To achieve a high efficiency of the activated coal, the use of pressure is recommended. The efficiency of the activated coal is low if the concentration of tar-forming hydrocarbons is high. Thus, original coking gas is less suited for activated coal treatment than is coking gas converted by thermal cracking. Generally, it can be said that activated coal can only be used for NO removal if the gases are free of substances which soil the surface of the coal. The situation is somewhat different if the benzene in the coking gas is recovered simultaneously with NO removal, since the costs of regenerating the activated coal are partly covered by the revenue obtained from the sale of benzene. Simultaneously with NO, NO2 is also removed to prevent corrosion by the flue gases. The use of the activated coal method for removal of small concentrations of nitrogen oxides under pressure is simple and even inexpensive if the gas is to be compressed anyway. Consumption of activated coal is low, particularly since the coal spent by NO adsorption from cracking gas can be used for adsorption elsewhere instead of fresh coal. The reaction mechanism is probably characterized by adsorption of nitrogen oxides on activated coal and reaction with active C-atoms of the coal surface. In addition, reaction of the nitrogen oxides with certain unsaturated hydrocarbons and the action of oxygen may play a role.

1947 APTIC NUMBER 18196

BAG COLLECTORS MEET CHICAGO POLLUTION CODE. Roads Streets, 112(7):97-98, July 1969.

Bag-type dust collectors have been installed by every asphalt hotmix producer in the city of Chicago. These units, used often in conjunction with various primary dust collecting equipment, are satisfactorily meeting Chicago's air pollution code which sets particulate emission at 0.1 grains of particulate material/standard cu ft of exhaust gas, and a stack emission no darker than No. 2 Ringelmann for continuous operation. Previously used wet scrubbers resulted in water vapor in the plume which caused opacity. Present dry bag collectors can collect 99.9% of the fine material in the emission gas without a vapor plume or any plume. The major asphalt plants are using bag collectors of three types: Mikro-Pulsaire, Dustex, and Flex-Kleen.

1948 APTIC NUMBER 17889

Boesner, Gerhard
UTILIZATION OF INDUSTRIAL AND RESIDUAL GASES BY THE METHODS OF THE LURGI ENTERPRISES. (L'Utilisation de Gaz Industriels et Residuels par les Procedes des Societes Lurgi). Text in French. Metallges. Periodic Rev., no. 13:22-31, 1936. 8 refs.

The modern trend in the chemical industry is to utilize processes in which the chemical reactions take place in the gas phase. This raises the problems of cleaning gases prior to their

reaction, as well as of processing the residual gases of that reaction. The Lurgi enterprises address themselves to the task of providing engineering solutions to these kinds of problems, including processes of purification of reacting gases of substances which 'poison the catalyst' used to accelerate or to make possible the desired reaction and processes of removel of dust and other particulate solids, of condensable vapors, and of gaseous constituents from the residual gases, with the objective of their recovery or of prevention of their discharge into the atmosphere. Various devices and existing industrial installations are reviewed, such as 'Multiklon' centrifugal dust separators, electrostatic filters for removal not only dry dusts but also condensable mists, scrubbing towers for selective absorption of gases or mists by liquid absorbents and the 'Benzotron' process of absorption by solid charcoal of benzene from city gas or coking-plant gas. A large section of the paper is devoted to the removal of sulfur dioxide and hydrogen sulfide from waste gases, the production of ammonium sulfate and particularly the production of sulfuric acid.

1949 APTIC NUMBER 16166

Rolater, F. G.
PHOSPHORUS FURNACE FUME CONTROL. J. Metals, 19(11):36-37, Nov. 1967.

A series of pilot plant studies of phosphorus production were made in an attempt to determine the volume of gases that it would be necessary to handle in order to clear the furnace taphole and slag runner area and to determine what method of scrubbing would be required to absorb the phosphorus oxide fumes. Elemental phosphorus is produced in electric furnaces by the reduction of phosphate ore with coke. A furnace plant located in close proximity to an expensive housing development in Tarpon Springs, Florida was of special concern. It was decided that a venturi scrubber operating at an overall pressure drop of 40 inches of water would be the best system. The collection and scrubbing equipment installed consisted of a venturi scrubber, saturation chamber, cyclonic separator, settling tank, exhaust fan, and exhaust stack.

1950 APTIC NUMBER 18151

Row, George R.
BAGHOUSE FILTER CONTROLS FINE DUST PARTICLES. Plant Eng., 23(14): 70, July 10, 1969.

Carbon black, used as a reinforcing agent in the manufacture of rubber tires, has presented many environmental problems since the particles are so small they fly about like smoke, penetrating clothing and skin pores. A cloth-bag shaker-type dust filter was found to be a satisfactory device for controlling the dust particles. Ductwork vents the carbon-black dust to a baghouse outside the mixer building. Air is drawn upward and through the filter bag cloth to a clean air manifold through an air reversal valve, leaving particles deposited on the inside bag surfaces. Clean air is then exhausted to the atmosphere. Bags in each compartment are shaken and flushed with reverse air for cleaning. This allows the carbon black dust to drop into a hopper trough which returns recovered material for processing. Substantial savings have resulted from the recovery of valuable fines formerly lost to the atmosphere.

1951 APTIC NUMBER 17979

Rudorff, D. W.
FULHAM WASHES FLUE GAS. Power, vol. 81:341-343, June 1937.

The flue-gas-washing plant of the 300,000-KW Fulham power plant in London (England), which will, when completed, consume 2200 tons/day of coal containing from 0.75 to 1.5% sulfur employs the Hondeu-ICI system of gas scrubbing which is capable of reducing the sulfur compounds in the flue gas to 0.02 grains/cu ft and its dust content to 0.08 grains/cu ft and its dust content to 0.08 grains/cu ft (at 1 atm and 32 F). In this scrubbing system, the intimate contact between flue gas and washing liquid is obtained by a combination of rain and surface-film action. Milk of lime is added to the washing water to achieve a substantially complete absorption and neutralization of sulfur dioxide and other acid constituents of the flue gas. This lime combines with carbon dioxide absorbed from the flue gas to produce (insoluble) chalk and (soluble) calcium bicarbonate. The latter is the active absorbing and neutralizing agent and fresh amounts of it are formed from the chalk as the absorption of SO2 and other acids proceeds. To keep up the supply of calcium bicarbonate and to prevent the recirculating liquor from becoming acid, fresh milk of lime is fed into the system at a rate proportional to the acid absorption. The pH valve of the washing liquor is maintained at 6.7 to 6.8 at the scrubber inlet and at 6.4 to 6.6 at the scrubber inlet and at 6.4 to 6.6 at the liquor exit from the scrubber. SO2 and SO3 contained in the flue gas are absorbed as calcium sulfite and calcium sulfate and the washing liquor becomes charged with these relatively insoluble compounds. When the degree of their supersaturation attains an empirically determined limit, their precipitation is allowed to take place in vertical delay pipes of large cross-section and considerable length. The sludge accumulating at the bottom is continually withdrawn and passed into a thickener plant from which the clarified liquor is returned to the scrubber; the thickened sludge is discharged into a barge.

1952 APTIC NUMBER 20090

Sato, Takeo
LOW SULFUR CRUDE OIL. (Teiio genyu). Text in Japanese. Nenryo Kyokaishi (J. Fuel Soc. Japan, Tokyo), 49(515):116-122, March 1970.

To meet new restrictions on the allowable sulfur content of fuel, Japanese oil companies are increasing their imports of low-sulfur crude and heavy oil and installing more plants for the hydrodesulfurization of heavy oil. According to government projections, the hydrosesulfurization facilities will be required to have a capacity of 650,000 BSD by 1973. The present capacity is 65,000 BSD. The current capacity of indirect desulfurization plants is 220,000 BSD. The ratio of low-sulfur crude oils to the total volume of crude oils must increase from 12% in 1968 to about 20% by 1973. Low-sulfur crude oils, which account for more than

40% of worldwide crude oil output, are effectively and cheaply desulfurized. Judging from their present distribution status, however, it appears unlikely that Japan can substantially increase its imports. It will instead have to rely on the costly desulfurization of heavy oil.

1953 APTIC NUMBER 17820

Schnuerer, F.
DRY DESULFURIZATION OF GASES. (Die Trockenentschwefelung von Gasen). Text in German. Erdoel Erdgas Z., vol. 83:284-288, Aug. 1967. 2 refs.

Dry desulfurization with iron oxide containing adsorbants has been primarily used for cleaning coking gases, synthesis gases, and recently for desulfurization of natural gas. Bog iron ore is used for adsorption of the hydrogen sulfide. The process takes place in two steps: (1) $2Fe_2O_3.H_2O + 6H_2S$ yields $2Fe_2S_3.H_2O + 6H_2O$, and (2) $2Fe_2S_3.H_2O + 3O_2$ yields $2Fe_2O_3.H_2O + 6S$. The process which requires addition of a maximum of 0.1% by volume of oxygen (or air) continues until the adsorbent loses its catalytic power through the increasing content of elemental sulfur. The adsorbent is then replaced by a fresh one. The reaction kinetics of the process are rather complex but they can be expressed by two differential equations with just two parameters: one for the maximum sulfur load, and the other for the reaction speed. The adsorbent adsorbs the highest amount at the gas entrance; with increasing distance from the entrance, the adsorption capacity diminishes. Thus, for best results, it is advisable to separate the adsorbent into several portions. For desulfurization of natural gas, the adsorbent was placed on small carts running on rails within a cylindrical vessel. For cleaning 90,000 cu m/hr, natural gas containing 40 mg/standard cu m $H_2S$ at 40 atm gauge, 110 cu m adsorbent are needed.

1954 APTIC NUMBER 17942

Segsworth, V. K.
VENTILATION AND DUST CONTROL AT THE FROOD-STOBIE CONCENTRATOR AND CRUSHING PLANT. Can. Mining J., 89(10):59-61, Oct. 1968.

Sources of dust dispersal are enclosed and vented at the Frood-Stobie concentrator and crushing plant, and a continuous supply of make-up air is provided in sufficient amounts to change the air in the mill completely four times each hour, and five times per hour in the crushing plant. Direct fired fan-heater units are mounted in the building walls to force into the plant the desired full volume of tempered outside air throughout the winter, and regular checks are made to determine the concentration of possible toxic contaminants in the undiluted air stream from all the direct fired heaters. Exhaust air escapes from the mill through one large roof ventilator, and in the crushing plant, all of the belt dumps, screens, and the crusher feed and discharge points are enclosed and vented to a single bag type dust collector. Provision is made for water washing of the undersize from the primary screens. A system of covers protects the fine ore bins and the belts feeding the bins in the concentrator proper, and a filter vents the dust while an axial flow exhaust fan returns clean air to the plant. Other conditions being equal, the efficiency of a dust filter cloth in cleaning air is a function of the static charges that can be induced in that cloth by the flow of air through it, in which respect terrycloth or dacron are very effective. The control room, office, and laboratory section are supplied with conditioned air that is heated as required by a gas fired unit of the exchanger type with built-in fans. Bag filters also provide dust control for the sample preparation plant and the belt transfer house between the crushing plant and mill.

1955 APTIC NUMBER 20106

Shayeson, M. W.
REDUCTION OF JET ENGINE EXHAUST SMOKE WITH FUEL ADDITIVES. SAE (Soc. Automotive Engrs.) Trans., 76(4):2687-2694, 1968. (Paper 670866.)

Combustion, engine, stability, and compatibility tests were performed to determine the effectiveness of compounds of barium, manganese, alkyl nitrate, iron, boron, lead, and organic peroxide in reducing jet engine exhaust smoke. The combustor used was J79-8/15 with a P5 fuel nozzle; JP-5 fuel was used for all tests, and a J79-8 engine was operated in a test cell to verify the results. A series of flight tests were conducted with four different engines, and results were compared with ground tests. Metallorganic compounds of barium, manganese, and iron were the most effective smoke reducing fuel additives. The effectiveness of additives in reducing smoke was a function of engine design and power level, while the organic portion of the additive molecule apparently had some effect on its ability to reduce smoke. The formation of solid exhaust products in the combustion of a manganese compound additive caused no major adverse effects on J79 engine operation in 100 hours.

1956 APTIC NUMBER 17812

Sicha, Vaclav and Jindrich Matys
METHOD OF REMOVING HYDROGEN SULFIDE FROM GASES. (Zpusob odstranovani sirovodiku z plynu). Text in Czech. (Assignee not given.) Czech. Pat. 121732. 1p., Jan. 15, 1967. (Appl. Aug. 24, 1965, 1 claim).

This method is claimed to overcome the disadvantages of the currently used wet and dry methods to purify hydrogen-sulfide gases. The gas is led over iron shavings wetted by solutions of substances forming complex of chelate compounds with iron or other metals able to transfer oxygen (e.g., sodium salts of bis-beta-hydroxyethylglycine etc.). The new method reduces space necessary for the purification process by two thirds, introduces shorter contact times and wetting ratio is minimal (1:50 thousands to 100 thousands). For example, if gas of $H_2S$ concentration 5-6 g/cubic meter is carried through the apparatus filled with Fe shavings wetted by 10% solution of complex forming oxygen carriers and contact time is 3-5 sec, 100% $H_2S$ removal results.

1957 APTIC NUMBER 20229

Siegel, Sanford M.

BIOLOGICAL PROCESS FOR PROTECTING PLANTS FROM ATMOSPHERIC CONTAMINANTS. (Union Carbide Corp., New York) U. S. Pat. 3,178,855. 5 p., April 20, 1965. 17 refs. (Appl. May 1, 1961, 9 claims.)

The contamination of vascular plants, e.g., tobacco plants, by airborne oxidants and oxiding air pollutants is substantially reduced by the application, either directly or in combination with biological carriers, of the following antioxidants and their derivatives: aralkylamines, hydrazines, indoles, hydropyridines, and olefins. The reducing property of the antioxidants depends on the presence, in the fundamental molecule, of one or more electron donating centers or substituents. Such centers can be localized on atoms with nonbonding electrons, delocalized (in theta-orbital systems), or consist of a combination of localized and delocalized centers. Electron releasing substituents which enhance antioxidant properties in the parent molecule are straight chain lower-alkyl groups containing 1-8 carbon atoms and hydroxyl and amino groups. When the antioxidants are applied in conjunction with water or water-soluble protectants, preferred solution concentrations are 0.01 to 0.0001 1 moles/l. When emulsions and suspensions are used, concentrations from 0.1 to 1.0 moles/l are recommended. The invention is particularly effective in protecting seedlings, flower buds, and vegetative buds from ozone damage.

1958 APTIC NUMBER 20039

Smolik, Jan
DUST SEPARATION BY MEANS OF TURBULENCE. (Novy klimatizovany mrakodrap). Text in Czech. Zdravot Tech. Vzduchotech, 12(3):124, 1969.

Theories of dust separation by means of turbulence were surveyed. Theories were also critically evaluated based on experimental results from literature. The Friedlander-Johnstone equations were recommended because they bring results nearest experimental values. A special experimental line was also proposed. (Author abstract modified)

1959 APTIC NUMBER 20794

Squires, Arthur M.
KEEPING SULFUR OUT OF THE STACK. Chem. Eng. Deskbook, 77(9):181-189, April 27, 1970. 44 refs.

New coal- or oil-fired power stations in the United States will commonly be on the order of 1000 to 2000 Mw by 1980 and the fuel consumption will range from 8000 to 16,000 tons/day of coal or 35,000 to 70,000 bbl/day of oil. Sophisticated equipment for removing sulfur from such large quantities of fuel in a unit adjacent to the power plant prior to final combustion may well be cheaper to build than devices for removing the sulfur oxides from enormous quantities of stack gases. Equipment is envisioned that would gasify solid fuel and treat the gas at elevated pressure, thereby handling only a small fraction of the molar flow and volume to be subsequently discharged from the stack following combustion. Such equipment might add no more than $10/kw capital cost because the power-generating machinery will cost less for a plant operating on sulfur-free fuel. Revenue from the sale of by-product sulfur would provide an offset against capital cost amounting to about $10/kw of capacity. The technical and economic feasibility of developing an intergrated fuel-chemicals-power complexes from existing coal gasification and fuel-oil desulfurization processes is examined.

1960 APTIC NUMBER 17926

Squires, B. J.
ELECTRIC ARC FURNACE FUME CONTROL AND GAS CLEANING. Conf. Filtration Soc., Dust Control Air Cleaning Exhibition, London, 1969, p. 16-21. 4 refs. (Sept. 23-25.)

Electric arc steel melting furnaces emit fumes to the atmosphere at several points: the furnace doors, the pouring spout opening, the roof openings that take the electrodes, and sometimes from the furnace roof ring. This, together with the fact that the furnace roof generally lifts and swings clear for charging, tilts back for slagging, and tilts forward for pouring, presents considerable problems for dust control engineers. Satisfactory systems for collecting the fumes into a duct system for cleaning before discharge to the atmosphere are canopy hoods, full hoods built directly on the furnace roof, semidirect hood control, side draft hoods, and direct shell evacuation. In the latter method, the fumes are drawn directly out of an additional hole in the furnace roof instead of escaping through other openings. Because the gases are practically undiluted, the method requires the smallest volume. Since gas cleaning costs are nearly proportional to the volume being handled, this system is one of the cheapest, particularly for furnaces of 50 tons and over. For cleaning the gases, high temperature fabric filters are used extensively in the U.K. and the U.S. These filters have several advantages over wet scrubbers and electrostatic precipitators: they are very simple to operate and the fluctuating conditions from an arc furnace system do not affect their high efficiency.

1961 APTIC NUMBER 20188

Squires, B. J.
FABRIC FILTER DUST COLLECTORS. THEIR USE IN THE VENTILATING, STEEL, NON-FERROUS METAL, CEMENT, POWER STATION AND CHEMICAL INDUSTRIES. Filtration Separation (Purley), 1967:228-239, May/June 1967. (Presented at the Meeting of the Filtration Society, Manchester, Jan. 17.)

Design aspects, industrial applications, and development of new fabrics for fabric filter dust collectors are reviewed. Fabric collectors are of three kinds: screen type filters, reverse jet or blow back filters at high filtering ratios, and tubular filters at normal filtering ratios; the latter are in most general usage, have undergone considerable recent development, and are described in detail. Theoretical criteria for fabric selections are noted. Some typical fabric filter installations are discussed. The use of a pre-coat filter aid in fabric filters to achieve very high cleaning efficiencies when filtering air and gas streams with low dust concentrations, such as the cleaning of atmospheric air for special ventilating systems, is one new application which has opened new fields for this equipment in the sewage, pharmaceutical, and steel

industries. Particular attention is paid to the use of fabric filter dust collectors to clean high temperature gases and to applications in the cement, non-ferrous, smelting, and carbon black industries.

1962 APTIC NUMBER 17810

Srbek, Josef, Mostislav Klimecek, and Lubomir Jager
PROCESS OF RECOVERING SULFUR DIOXIDE FROM EXHAUST GASES. (Zpusob zachycovani kysliniku siriciteho z odpadnich plynu). Text in Czech. (Assignee not given.) Czech. Pat. 108093. 3p., Aug. 15, 1963. (Appl. Nov. 15, 1958, 2 claims).

A process of recovering sulfur dioxide during the last stages of sulfuric acid manufacture is presented. The exhaust gas is channelled to the absorption device, where a solid compound of zinc is in water suspension. The process is characterized by using only that amount of the water suspension of zinc oxide or hydroxide which corresponds to the amount of the absorbed SO2 from the exhaust gases. To prevent solidifying the suspension, a very diluted suspension below 3% of the total amount of zinc should be used.

1963 APTIC NUMBER 20120

Stahman, Ralph C., George E. Kittredge, and Karl J. Springer
SMOKE AND ODOR CONTROL FOR DIESEL-POWERED TRUCKS AND BUSES. SAE (Soc. Automotive Engrs.) Trans., 77(3):1657-1693, 1969. 5 refs. (Paper 680443.)

Diluted samples of exhaust from trucks powered by Cummins NH 220 four-cycle engines and buses powered by GM Detroit Diesel 6-V-71 two-cycle engines were presented to a panel of odor judges, who rated the intensity and quality of the odor in terms of reference standards. Smoke measurements were made with a PHS-designed optical smokemeter, and experiments were conducted to measure the effectiveness of a variety of control techniques. Although smoke emissions from the buses were substantially lower than from trucks, the buses presented a worse odor problem. Fumigation systems which meter a small amount of fuel into the intake manifold of the engine to initiate precombustion reactions before and during the compression stroke decreased exhaust smoke from both engines but only at low engine speeds. Significant smoke reductions occurred when air was injected as close as possible to each exhaust valve of a four-cycle engine, probably due to oxidation of the carbon particles; but no beneficial effects were observed when this system was investigated with a two-cycle engine powered bus. Engine derating was attributed to reduced emissions of two over-the-road tractors, although a third tractor exhibited very low baseline smoke characteristics, and tests with a 5 truck fleet using a single commercial fuel additive confirmed significantly reduced smoke levels. The Jacobs Engine Brake showed no promise in reducing smoke and odor, while two types of catalytic mufflers showed significant influence on odor levels.

1964 APTIC NUMBER 17912

Stairmand, C. J.
THE DESIGN AND PERFORMANCE OF MODERN GAS-CLEANING EQUIPMENT. J. Inst. Fuel (London), 29(181):58-76, Feb. 1956. (Presented before the Institute, in London, Nov. 23, 1955.)

The main methods of large-scale dust collection, namely cyclones, electrostatic precipitators, fibre and fabric filters, and wet scrubbers, including impingement scrubbers, disintegrators, spray towers, and venturi scrubbers are reviewed. In each case a brief discussion of the probable mechanism of operation is given, with a practical 'grade-efficiency' curve, obtained from accurate tests on installed plants. Finally, a method of economic assessment is described, showing how the collectors can be compared in terms of total operating costs, related to their collection efficiencies on a standard test dust. Two appendices are included. The first gives a worked example showing the method of predicting from the appropriate grade-efficiency curves the performance of a cyclone-electrostatic precipitator dedusting installation; the second describes the test procedure for industrial dust collectors, and the precautions which are necessary to ensure accurate test results.

1965 APTIC NUMBER 17904

Stastny, E. P.
CHOOSING YOUR ELECTROSTATIC PRECIPITATOR. Power, 104(1):61-64, Jan. 1960.

A combination of dust-collection and gas-cleaning efficiency is both an art and a science. Some of the variables encountered which must be considered are presented. The desired performance and relative size, factors effecting size, rectifiers, gas composition, temperatures, pressures, fuels, water vapor, dust loading, dust-particle size range, and duct-work design are briefly discussed. Buying precipitators for recoveries under 80% is an expensive venture and is rarely considered, unless other cleaning equipment is not available or suitable. The higher the required recovery efficiency, the larger is the precipitator's treatment zone. Precipitator efficiency depends on a high-voltage dc source. Though voltage is high, current input to any one precipitator rarely exceeds one amp. About 700 F is usually the temperature specified for handling dry dust. Unfortunately, this coincides with peak-resistivity temperature of most dusts. Gas pressures for most precipitators include plus or minus 30 in. of water. High-sulfur fuels (2 to 4%) yield quantities of SO2 and SO3 favoring electrostatic precipitation. Amounts of water vapor between 5 and 10% by volume are helpful in reducing ash resistivity. Generally, the greater the dust load, the higher the precipitator's efficiency must be to hold residuals to proper limits. One of the cardinal principles of good precipitator performance is that gas distribution must be uniform at the inlet.

1966 APTIC NUMBER 20823

Stites, Joseph G., Jr.
SUCCESSFUL REMOVAL OF SO2 FROM FLUE GAS. Nat. Eng., 74(5):8-9, May 1970. (Presented at the Industrial Coal Conference, University of Kentucky, Lexington, April 8-9, 1970.)

A catalytic oxidation system to desulfurize flue gases is described. Flue gas at 950 F is first passed through a mechanical and electrostatic dust collector and then through a converter where the oxidation of sulfur dioxide to sulfur trioxide is accomplished. The heat recovery equipment consists of an economizer, a rotary regenerative air preheater, and an absorption tower. As the temperature is lowered, the SO3 and water vapor in the flue gas combine to form sulfuric acid mist in dropletes, which are removed in the absorption tower and mist eliminator. The motive power for this system is furnished by an induced draft fan, immediately preceding the stack. Ash removal is accomplished at an efficiency of about 100%. Approximately 90% of the SO2 in the flue gas is oxidized and removed. The mist eliminator removes more than 99.5% of the acid mist. The strength of the acid is a function of the operating temperature of the absorption tower, but averages 80%.

1967 APTIC NUMBER 17809

Svonava, Marian, Jan Palka and Mikulas Gregor
COMPARISON OF THE EFFICIENCY OF REMOVING CARBON DIOXIDE FROM WASHER GAS BY MEANS OF HIGH-PRESSURE WATER. (Porovnanie uiinnosti vypierania kyslicnika uhliciteho 2 plynu tlakuvou vodou v naplnovej pracke a v pracke s penovym rezimom). Text in Czech. Chem. Prumysl (Prague), 19(1):1-5, 1969. 15 refs.

The efficiency of various types of washers was studied to evaluate the most economical one. In packed washer the following substances were used to clear the washer from organic substances: chlorine chloramine, potassium dichromate, pentachlorophenic sodium, copper sulfate and iron sulfate. All substances with the exception of chlorine were not efficient enough. The disadvantage in using chlorine was the strong corrosive effect. Drops gave a 50% better washing. The greatest disadvantage of this system is the incapability to manipulate with the power of the washer. Cyclone washers use thin film layer of water against which the gas is blown. This system may be applicable for not too high columns, as the speed of gas and water must be very high. Bubble washers use a large contact area between the gas and the water. The system is of great advantage in power wash, where a large volume of gas must be washed by a small amount of fluid. It fives 100 percent use of working hours, without needed cleaning of the system. Foam washers practically double the power of the equipment, with the prevention of biological and mechanical depositions. This is due to high speed through the holes in partition walls. This system makes possible use, without long maintenance periods, which reflects in the production of gas work.

1968 APTIC NUMBER 17985

Szantho, Eugen v.
AGGLOMERATION OF DUST IN SMOKE FLUES. Staub (English Translation from German of: Staub, Reinhaltung Luft), 29(8):6-9, Aug. 1969.

Agglomerates in flue gas were determined by a measuring device with collecting plates. The measurements were taken downstream of a precipitator at 4 different points. Large agglomerates downstream of the collector are smashed by impaction at the head draft baffles, and largely dispersed. Behind the head draft, reagglomeration begins. The agglomerates rapidly enlarge on their way up the stack. The presence of electrical charges in the flue gas explains the influence of charging upon agglomeration. Two methods were used to determine these electrical charges: a field strength measurement, and a current flow measurement. They were taken with platinum wire and spherical probes. The influx of negatively charged clouds basically originates from the discharge field of the precipitator; in contrast to this, the positive excess charge is mainly formed by a back discharge on the collecting electrode. Behind the dust removal installation, there are very fine dust particles which are charged positively and negatively. In the case of clouds of opposite charges, the individual particles agglomerate as a result of electrostatic forces of attraction. The agglomeration essentially depends on the particle size characteristics of dust and on the operation of the electrostatic precipitator.

1969 APTIC NUMBER 20793

Tamura, Zensuke and Yukio Hishinuma
METHOD AND APPARATUS FOR DESULFURIZING COMBUSTION WASTE GASES. (Hitachi, Ltd., Tokyo (Japan)) U. S. Pat. 3,473,297. 6p., Oct. 21, 1969. 5 refs. (Appl. Sept. 8, 1967, 12 claims).

Method and apparatus are described for removing sulfur oxides from waste gases by means of active carbon. The apparatus comprises a sulfur oxide adsoprtion region, water-washing and desorption region, adsorbent drying region, and means for pouring water into the desorption region and for heating the water to be poured into the last mentioned region. Washing efficiency of a unit quantity of water in desorbing the sulfur oxides present on and in the active carbon can be enhanced by intermittently repeatedly pouring the water at such a time interval as to permit the sulfur oxide concentration on the surface of the active carbon to becose the same as that interior of the carbon. (Author abstract modified)

1970 APTIC NUMBER 17825

Thomas, F. A.
VENTURI GAS SCRUBBERS. (II). J. Metals, 17(3): 264-266, March 1965.

Several years ago, a venturi gas scrubber was placed in operation at a steel plant on an open-hearth furnace. The general gas scrubber design, operating principles, and results obtained on this installation are outlined. Gas cleaning in the open hearth presents a major challenge, due to the variable dust loading, particle size, and temperature of the exhaust gases. The venturi gas scrubber is designed to overcome these obstacles and to cleanse waste gases to a satisfactory level. The venturi scrubber installation is illustrated. The venturi gas scrubber will clean open-hearth waste gases to 0.05 grains/std cu ft of waste gas with a pressure drop of 30 in. of water across the scrubber, or to 0.01 grains/std cu ft of waste gas with a pressure drop of 40 in. of water, and with an average scrubbing water rate of about 14 gal/1000 std cu ft of gas. Bleeding 5% of the total scrubbing

water, containing 1.5% solids by weight, permitted satisfactory operation of the recycle water system. In the older open-hearth shops without waste heat boilers, the venturi gas scrubber, with its ability to handle hot gases directly, provides both satisfactory gas cleaning and increased furnace draft. The lower capital cost, as compared to electrostatic precipitators, makes the scrubber an attractive investment. Also, it is possible to design a scrubber for an open-hearth shop so that it can be used for a future basic oxygen steel making installation, thereby attaining a dual benefit from one capital expenditure.

1971 APTIC NUMBER 17909

Thumm, Wilhelm
METHOD FOR THE RECOVERY OF SO2 FROM SO2 CONTAINING GASES. (Verfahren zur Aufarbeitung von SO2-haltigen Gasen). Text in German. (Metallgesellschaft A.G., Frankfurt, (W. Germany.)) W. German Pat. Appl. 1,048,922. 4p., July 30, 1959. 1 ref. (2 claims).

An improvement of the familiar process for recovering sulfur dioxide by scrubbing with aromatic amines is described. Only a fraction of the SO2 contained in the total incoming gas flow is concentrated to 100% gaseous SO2. The gas flow with a residual SO2 content of at least 2% (preferably 5 to 6%) is used for the preparation of sulfite solutions. By this method, any recovery of the amine vapors is avoided. No H2SO4 for the amine scrubbing and no NaOH for the dissociation of the amine sulfates is required. With this improvement, the SO2 concentration process now consists of the following steps. Gas with an SO2 content of 15% enters the absorption tower. The scrubbing liquid consisting of toluidine, bisulfite, and water loaded with 170 g SO2/l is recovered by heating to the boiling point. The 100% SO2 obtained thereby is dried and processed in the familiar way. The inhomogeneous mixture of toluidine and aqueous solution is returned to the absorption tower where it enters in medium height. Part of the loaded scrubbing liquid is branched off to the top of the tower. The remaining gas leaving the absorption tower has an SO2 content of 6.2% and a toluidine content of less than 0.1g/standard cu m. It is passed to a two-stage absorption plant containing Na2SO3 solution. The preparation of NaHSO3 solution follows the familiar procedure.

1972 APTIC NUMBER 17918

Thumm, Wilhelm
METHOD OF TREATING SULFUR DIOXIDE CONTAINING GASES WITH INORGANIC OR ORGANIC BASES. (Verfahren zur Behandlung von Schwefeldioxyd enthaltenden Gasen mit anorganischen oder organischen Basen). Text in German. (Metallgesellschaft A. G., Frankfurt (West Germany)) W. German Pat. Appl. 1,025,400. 2p., Oct. 11, 1956. (Appl. date not given, 6 claims.)

A method was devised for treating sulfur dioxide containing gases with inorganic or organic bases. The aqueous solutions or water containing emulsions of the organic bases are injected by one or more nozzles into an empty tower. The gas enters on the same level as the liquid tangentially in the direction of the inflowing liquid. The speed of the gas must be high enough to form dispersions or foam. It can be varied between 0.2 and 8 m/sec. The diameter of the droplets of the liquid may range from 0.1 to 5 mm. The treatment may be repeated in the same way in several subsequent towers. The gas and liquid are mixed such that foam is formed on the level of the nozzles. It rises to the top of the tower and falls in the form of rain back into the sump. For example, gas with 2.2% by volume of SO2, 9% CO2, 9% O2 and the remainder N2 was passed through three empty towers (height equals 6 m; inner diameter, 600 mm) with a speed of 3.5 m/sec. It was scrubbed with a mixture of toluidine-xylidine and an aqueous salt solution (mixing ratio 1:1). Through the use of empty towers and the special arrangement of the nozzles, sulfate formation was three times lower than in packed towers of 6 m height and 1 m diameter. Also, three times less sodium hydroxide was needed to keep the sodium sulfate content in the scrubbing liquid constant.

1973 APTIC NUMBER 17911

Thumm, Wilhelm, Ernst Wegener, Gerhard Roesner, and Josef Barwasser
SCRUBBING METHOD FOR THE REMOVAL OF SO2 FROM GASES WITH THE AID OF AROMATIC BASES. (Verfahren zum Auswaschen von SO2 aus dieses enthaltenden Gasen mittels aromatischer Basen). Text in German. (Metallgesellschaft A. G., Frankfurt (West Germany)). W. German Pat. 952,892. 4p., May 11, 1952. (Appl. date not given, 3 claims).

A method was devised for scrubbing sulfur dioxide from gases with the aid of aromatic bases. The gas and the absorbant are mixed intensely in a spray tower which is combined with a centrifugal separator. After a contact time of 2 sec, which suffices for complete removal of the SO2, the gas and the liquid are separated again by the centrifugal forces. This prevents further reactions leading to sulfate formation. The spray tower with the centrifugal separator contains one or more propeller blades. By using several apparatuses, stepwise operation is feasible.

1974 APTIC NUMBER 20003

Toche, M. Jean
UNDERGROUND STORAGE OF LIQUID METHANE. (Stockage souterrain de methane liquide). Text in French. Preprint, Association Technique de l'Industrie du Gas en France, 22p., 1961. 5 refs. (Presented at the Association Technique de l'Industrie du Gaz en France Congress, 1961.)

Underground storage of liquid methane at -161 deg C presents many problems, and studies were undertaken by Gaz de France to determine the mechanical stability of a cavity whose walls experience steep temperature gradients. Theoretical calculations of heat propagation rate in a homogeneous terrain are recalled, but mechanical and thermal properties of the rock are needed for close numerical application of the formulae. Three cavities with a capacity of about 25 cu m are presently being studied to check whether theoretical data permit extrapolating and planning industrial-scale cavities with a capacity of tens of thousands of cubic meters. (Author abstract modified)

1975 APTIC NUMBER 20010

Trayser, D. A. and P. A. Creswick
EFFECT OF INDUCTION-SYSTEM DESIGN ON AUTOMOTIVE-ENGINE EMISSIONS. Preprint, American Society of Mechanical Engineers, New York, 9p. 1969. 17 refs. (Presented at the American Society of Mechanical Engineers, Winter Annual Meeting, Los Angeles, Calif., Nov. 16-20, 1969, Paper 69-WA/APC-7.)

One approach to reducing engine exhaust emissions is to operate with leaner air/fuel mixtures. However, unsteady engine operation which is encountered with the leaner mixtures is limiting the extent to which this approach can be used. Improvements in induction system design to promote more uniform distribution of fuel and air are necessary to extend the lean-mixture operating limit. Analytical studies indicate that maldistribution of fuel and air can be corrected by improvements in the fuel atomization characteristics of the carburetor and by the adoption of intake manifolds designed for minimum impaction of entrained particles. Approaches to improving atomization are represented by ultrasonic, spinning disk, and impinging-jet atomizing devices that will produce full droplet sizes approaching 10 to 20 micron under all operating conditions. The design of low-impaction manifolds requires further experimental studies to determine the behavior of fuel droplets in real, three-dimensional, pulsating flows.

1976 APTIC NUMBER 18138

Trobisch, Karlheinz
REMOVAL OF HIGHLY VOLATILE HYDROCARBONS IN THE PETROCHEMICALS INDUSTRY THROUGH WASTE-WATER STRIPPING AND CATALYTIC PURIFICATION OF WASTE GASES. (Beseitigung leichtfluechtiger Kohlenwasserstoffe in der Petrochemie durch Abwasserstrippung mit katalytischer Abluftreinigung.) Text in German. Staedtehygiene (Uelzer/Hamburg), 20(5):118, May 1969.

The waste water of the Hoechst petrochemical plants contains, after leaving a separator, 1 kg of highly volatile hydrocarbons per 250 cu m waste water. Approximately 80% of the hydrocarbons are removed by allowing the water to trickle downward through a packed column, with regenerator gas plus air being fed through the same column in a countercurrent direction. The stripped water is further purified in a biological treatment plant, while the gas-air mixture passes through a catalytic afterburner in which the hydrocarbons are burned at 400 deg to CO2 and water vapor.

1977 APTIC NUMBER 20796

Turk, Amos
INDUSTRIAL ODOR CONTROL. Chem. Eng. Deskbook, 77(9):199-206, April 27, 1970. 13 refs.

Accepted methods of odor control are examined with special emphasis on what can go wrong in the methods themselves or in assumptions of the degree of control thought to be necessary. Odors are extremely difficult to measure, and it is equally difficult to decide what levels are accepted. Distance from a source at which odor may be detected is not predicted even approximately from dilution ratios and dispersion calculations. Meteorological dispersion formulae give little help in estimating the ratio of peak to mean concentration, since the parameters they incorporate are to a large extent empirical and are well established only for prolonged release and average plumes. Particles may contribute to odor if they are volatile, if they release adsorbed odorous vapors, or they are indeed odorous in themselves. Thus, if a single particle carries odor, it constitutes transport without dilution. Complete oxidation of odorous vapors eliminates their odors, but when oxidation is incomplete, the odor quality may actually get worse before it gets better. Catalyst deterioration, selection of temperature and residence time, and comparison with solvent recovery are some of the main problems in air oxidation to which the engineer should be alert. Other oxidizing agents used for deodorization include ozone, chlorine, chlorine dioxide, hypochlorites and permanganates, but the question of odors of intermediates may be critical. Activated carbon is the only practical adsorbent that can be used for odor control because its performance is not weakened by the presence of moisture, but there are problems of catalytic action, rapid saturation from spills and vapor surges, and special reactivation methods. The vapor screen or neutralization concept consists of interposing a vertical wall of odor-neutralizing vapor between the odor source and the sensitive noses of neighborhood residents. Washing and scrubbing, counteraction and masking are also considered.

1978 APTIC NUMBER 17922

(Inventor not given.)
METHOD AND EQUIPMENT FOR CLEANING ACID CONTAINING GASES. (Verfahren und Vorrichtung zum Reinigen saeurehaeltiger Gase). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt Germany) W. German Pat. 679,709. 2p., Jan. 17, 1936. (3 claims).

A method is described for cleaning sulfur trioxide, sulfuric acid, or nitrogen oxide containing gases in an electric high-voltage field, characterized by the use of an electrostatic precipitator whose iron collection electrodes are sprayed with 68 to 80% sulfuric acid. The use of iron reduces the investment costs for the electrostatic precipitators and also the space requirement. The additional energy needed for the acid spraying is low, since the acid quantity is small. The acid which flows off is used in the lower section of the apparatus for scrubbing the gas from nitrogen oxides. The electrostatic precipitator consists of an iron pipe of 350 mm inner diameter in whose axis is suspended the electrode of lead-coated iron. The voltage between the electrode and the pipe is 65,000 volt. On top of the tower, 250 cu m of gas with 0.6 g SO3 and 1.5 HNO3/cu m enter each hour. Through a lead pipe are added 100 kg acid with 78% H2SO4 and 0.39% HNO3. A lead ring with holes in it distributes the acid. The cleaned gas leaves with 0.06 g SO3 and 0.71 g HNO3.

1979 APTIC NUMBER 17983

(Inventor not given.)
METHOD FOR THE RECOVERY OF SULFUR DIOXIDE FROM GAS MIXTURES. (Verfahren zum Gewinnen von Schwefeldioxyd aus Gasgemischen). Text in German. (Raschig (F.) G. M. b. H. Chemische Fabrik,

Ludwigshafen (West Germany)) West German Pat. 570, 027. 2p., Jan. 26, 1933. (1 claim).

A method of recovering sulfur dioxide from gas mixtures is characterized by scrubbing the gas mixture with tetrahydronaphthalene. For example, roasting waste gas with about 5% by volume of SO2 was passed through 100 kg tetrahydronaphthalene. After saturation, the SO2 was precipitated from the tetrahydronaphthalene in a vacuum; 2.4 kg pure SO2 was obtained. The waste gas left the scrubber with 0.1% SO2.

1980 APTIC NUMBER 17984

(Inventor not given.)
METHOD OF PRODUCING SULFUR FROM SULFUR DIOXIDE AND HYDROGEN SULFIDE. (Verfahren zur Gewinnung von Schwefel aus schwefliger Saeure und Schwefelwasserstoff). Text in German. (Walther Feld) West German Pat. 202,349. 3p., Sept. 29, 1908. (7 claims).

A method was devised for producing sulfur from sulfur dioxide and hydrogen sulfide characterized by passing these gases simultaneously or successively through a heated reaction liquid. Any liquid can be used for this purpose which is capable of dissolving the developing sulfur. It is recommended to use tar oils obtained from the distillation of organic substances. The sulfur-laden oil is cooled and the sulfur is thereby precipitated in crystals. The crystals are separated from the solvent and washed with steam. To increase the reaction speed, organic or inorganic substances are added which from compounds SO2 and H2S and dissociate again when heated with liquids. Aromatic amines, amides, nitriles, thiamides, inorganic ammonium bases, and alkaline magnesia and ammonia can also be used. If tar bases are used as a means increasing the reaction speed, the sulfates of these bases form. The effectiveness of the bases ceases as soon as the bases are converted into sulfate. For recovering the bases, the oxides, hydrates, carbonates, sulfides, and sulfites of the alkalies and earth alkalies of ammonium, magnesium, and aluminum can be used.

1981 APTIC NUMBER 20817

Walker, Alan B. and Norman W. Frisch
SCRUBBING AIR. Sci. Technol., no. 95:18-21, 24-27, Nov.-Dec. 1969.

Several devices and methods for controlling air pollution are discussed. The simplest particulate collector is the dry inertial or mechanical type of which the most common is the cyclone. Mechanical collectors are applied where the particulates are coarse, high efficiency is not required, and concentrations of entrained particles are high. Less simple and more costly are the wet, inertial scrubbers which can collect droplets and particulates. There are many types, all operating on the principle of impaction on wetted surfaces or on individual droplets of the scrubbing liquid. Most filtration methods to remove particles from a gas use fabric filters. The most highly developed are fabric bags inflated with the gas to be cleaned. The electrostatic precipitator is unique because it applies its cleaning action only to the particulates, and its power input requirement is thus very low. It is suited for very large gas volumes, and can collect particles down to sub-micron size with high efficiency. Flame afterburners can remove combustible aerosols and gases, eliminate toxic or odorous compounds and the danger of explosions, with efficiencies of 90% or more. A tall chimney is also an air pollution device, because some pollutants, when released in the air, are acted upon by natural processes that convert them to relatively harmless substances. Adsorption and absorption are also discussed, and the costs of these methods are given.

1982 APTIC NUMBER 20200

Wallace, DeYarman
BLAST FURNACE GAS WASHER WATER RECYCLE SYSTEM. Iron Steel Engr., 1970:83-87, April 1970.

Water used for washing blast furnace flue gases usually drains by gravity to a settling basin or thickener where solids are precipitated and the water is discharged to a sewer or stream. To provide more adequate facilities for reducing solid losses, the washers on four blast furnace cleaning units were first converted from the spray type to venturi. The conversion drastically reduced the flow of water to be handled and permitted a recycling system to be constructed. Water containing the flue dust is directed to one of two thickeners, the combined capacity of which is 4000 gpm of dust-laden water. As the dust is separated in a thickener, the clarified water overflows into a clear well. Water from the well is recycled back to the scrubbers by pumps through a common header line. Deposit buildup in the line is minimized by maintaining the alkalinity and hardness of the water at 400 and 450 milligrams per liter, respectively. Alternatives for handling flue dust sludge have been designed into the system. When the moisture content of sinter mix ingredients is normal, the slurry from the thickeners is added to the mix by piping liquid slurry to pug mills for required moisture control. When sinter mix ingredients are high in moisture, the flue dust slurry is filtered to reduce moisture content. The waste control facilities for the recycle system cost in excess of $2,000,000.

1983 APTIC NUMBER 20080

Walton, P. J. and R. G. Boothroyd
A PULSATION-FREE FILTER FOR HIGH SOLIDS-GAS LOADINGS USING REVERSE-FLOW AND MECHANICAL CLEANING. Filtration Separation (Purley), vol. 7:144-149, March/April 1970. 7 refs.

Some form of frequent bag filter cleaning is essential at high solids loadings. Because of the relatively high pressure differential across the filter which holds the cake firmly on the bag, shaking or vibrating the bag by itself is usually insufficient to dislodge the filter-cake. Reverse-air cleaning is usually used to overcome this problem; but if incorrectly adjusted, this can allow excessive pressure to develop across the filter. Reverse-flow cleaning also produces pressure pulsations which increase in size with the mean pressure differential of the filter. New bag filter equipment and a cleaning technique which eliminates pressure pulsations are described. Six filters are housed in a pressure vessel. Each bag is supported on a wire cage suspended at its upper end and free to rotate about its axis. The lower end

of each bag is located axially by a felt-covered bearing. Each bag, which can rotate between 2 and 16 rpm, is cleaned by brushing with static strips located axially at opposite sides of the bag. The disadvantage of this method is that brushing decreases the permeability of the filter cake, thus causing increased resistance to filtration.

1984 APTIC NUMBER 17968

Ward, J. A.
LOW TEMPERATURE PIPELINE SYSTEMS FOR LIQUID NATURAL GAS. Gas. J., vol. 334:356-357, June 19, 1968.

The most economical way to convert stored liquid natural gas to high pressure gas for pipeline distribution is first to pump the liquid to high pressure at 160 C and then to add heat to transform it to the gaseous phase at close to ambient temperatures. Such conversion requires low temperature pipelines working at up to 100 psig. These pipelines pose special problems with regard to the materials used, allowance for contraction on cooling, methods of support, flange and bolting designs, insulation, and suitable valves. Acceptable materials for the pipes are the higher magnesium content aluminum alloys. Butt welds of high quality can be obtained by welding done by the argon arc tungsten inert gas process. If these butt welds are joined to weld neck type flanges, pipelines can be subjected to radiographic examination. Six-in. thick layers of expanded ebonite material (Onazote) used on liquid pipelines of 8-in. diameter and above prevent frosting of the outside cover. This material, plus advanced insulation techniques, makes possible the transmission of liquefied natural gas over long distances.

1985 APTIC NUMBER 20014

Wasilewski, L., J. Z. Zaleski, A. Kaczorowski, and W. Radzynski
THE METHOD OF PRODUCTION OF SULFUR DIOXIDE AND PORTLAND CEMENT FROM GYPSUM. (Otrzymywanie dwutlenku siarki i cementu portlandzkiego z gipsu). Text in Polish. Przemysl Chem., vol. 18:643-647, 1938. 15 refs.

The decomposition of gypsum was studied on laboratory, semi-technical, and plant scales. Laboratory studies determined the effect of temperature and of additions of carbon, silcion dioxide, and iron and aluminum oxides on the rate of calcium sulfate decomposition. The effect of carbon and iron oxides was most prominent. The effectiveness of CaSO4 decomposition as dependent upon coke, clay, and iron ore addition in varying amounts was studied in a four-meter-long rotating furnace at different temperatures. The agreement with the lab results was good. At the same time, the concentration of SO2 in exhaust gases was determined for each separate experiment. At 1200 deg, it was about 3.5 %. The plant testing was carried out in a 40-meter-long furnace. When appropriate amounts of coke are added, the most favorable conditions of decorposition result, yielding SO2 in concentrations high enough for H2SO4 production; as a byproduct, Portland cement is obtained. The excessive addition of coke results in CaS formation in the firing remnant, thus lowering clinker quality. Insufficient amounts of coke yield clinker with a high content of CaSO4; thus, effectiveness of gypsum decomposition is lowered. The optimum amount of coke when the clinker is free of CaS depends on the temperature and firing conditions. The results of the study can serve as a basis for industrial design of H2SO4 and Portland cement production from gypsum.

1986 APTIC NUMBER 20020

Wehinger, Egon F.
EXHAUST GAS TREATING DEVICE. (Hugh Oliver) U. S. Pat. 3,485,039. 5p., Dec. 23, 1969. 5 refs. (Appl. Dec. 29, 1967, 9 claims).

A device is described for treating exhaust gases issuing from internal combustion engines which ensures controlled mixing of the hot exhaust gases with a predetermined amount of air. Highly turbulent heating chambers are provided where interaction between the air and the exhaust gases may take place, while a pair of venturi passages ensures controlled flow of the exhaust-air mixture through the treating chambers. Gas directing vane apparatus connects the first and second treating chambers and forms a major portion of the wall between the chambers. It comprises a plurality of axially aligned slot forming members having upstream ends projecting into the first treating chamber and downstream ends projecting into the second treating chamber. While flowing in the annular passage, the gases are reheated by radiation and convection from the hot wall of the reduced diameter portion of the funnel-shaped partition member.

1987 APTIC NUMBER 20026

Weidmann, Hans and Gerhard Roesner
PROCESS FOR THE MANUFACTURE OF PURE SULPHUR DIOXIDE. Metallges. Periodic Rev., no. 11:7-13, 1936. 25 refs. (Also: The 'Sulphidine' Process for Recovering Sulfur Dioxide. Ind. Eng. Chem., Vol. 14: 105, March 20, 1936.)

The sulphidine methods for manufacturing sulfur dioxide consists of washing gases containing the SO2 in a scrubber with a 1 to 1 mixture of xylidine and water, adding sodium carbonate to convert any xylidine sulfate present to sodium sulfate, and heating to 80-100 C to drive off pure sulfur dioxide. The removal of sulfate from the solution is accomplished by withdrawing the aqueous layer and replacing it with fresh water. By conducting the absorption at 15-30 C, the exit gases from the absorbers can be reduced to as low as 0.1% sulfur dioxide, giving an efficiency above 98% with a raw gas containing as much as 7% sulfur dioxide. The regeneration of the sulfur dioxide is substantially complete as the process is operated and the gas is better than 99% pure. The amount of xylidine vapor escaping from the absorbers with the waste gases is rather high and these must be washed with alkaline bisulfite or sulfuric acid solution, from which the xylidine is received in the desulfation of the absorbent solution. The advantage of the process rests in the ability of the absorpent to utilize gases of low concentration

1988

APTIC NUMBER 18167

Werner, R. P., and J. G. Singer
400-MW CYCLIN UNIT SLATED FOR JUNE, 1971. Elec. World, 170(b): 30-31, August 19, 1968.

A 400-Mw, heavy oil fired, cycling unit will be installed by Connecticut Light & Power Co. at its Montville station. The turbine unit features quick response, greater reliability, and low capital cost. Main steam conditions at the throttle will be 1800 psig and 950 F with a single reheat to 90 F. The unit will be designed to meet proposed state and federal criteria for air quality. The oil-fired boiler will emit negligible particulate and require no fly-ash handling. As in other NU generating stations, injection of a magnesium-oxide fuel-oil additive will eliminate acid smuts and reduce sulfur trioxide. Intention is to operate the boiler at 3% excess air to further reduce sulfur trioxide. The boiler's tangential firing affords the opportunity to achieve low-excess air operation at least cost and with fewest operating problems. The gas leaving the boiler will be 600 F. This combined with a stack discharging at 409 ft elevation would produce the same plume rise as that from a 1000 ft stack with the usual exit-gas temperature. This plume rise will promote dispersion of stack gases, even during temperature inversions and smog-producing conditions. The design does not preclude the later installation of SO2 scrubbing equipment.

1989

APTIC NUMBER 17960

White, George
TGT TO BRING LNG TO NEW ENGLAND. Gas, 41(11):55-59, Nov. 1965.

A liquefied natural gas storage facility is described that will deliver peaking service to the New England area by pipeline. The project will use two in-ground tanks of 500,000 bbl, or 1.5-billion capacity each. The tanks will be approximately 130 ft in diameter by 180 ft deep. The liquefied natural gas level will be maintained at a maximum height of 2 ft below ground to eliminate any danger of spillage or leakage of liquid gas. The tanks will have nine percent nickel steel covers. A positive gas pressure of 6 in. of water will be maintained inside the tanks. Relief valves will be provided to take care of sudden pressure changes or other emergencies. An external dry powder extinguisher system will be installed near the top of the tank. Buildings within an area adjacent to the tanks in which radiant heat would present a hazard will be protected by a waterspray system. Liquid from the tanks will be revaporized by pumping it up to line pressure, passing it to a heat exchanger which utilizes a gas flame burning under water, and through a large water bath maintained at a temperature below boiling.

1990

APTIC NUMBER 20238

Whitney, Roy P. and J. E. Vivian
ABSORPTION OF SULFUR DIOXIDE IN WATER. Chem. Eng. Progr., 45(5):323-337, May 1949. 27 refs.

Experimental results are presented for the absorption of sulfur dioxide in water in a tower of 8-in. diameter, packed to a height of 2 ft. with 1-in. ceramic rings. The liquor rate was varied from 900-12,000 lb/hr sq ft; the gas rate was varied from 65-850 lb/hr sq ft; and the temperature was varied from 50-90 F. Overall coefficients for sulfur dioxide absorption showed all the characteristics of a system where both film resistances exert an appreciable effect. They increase markedly with increasing liquor rate, gas rate, and temperature. The overall coefficients were broken down into values for the two film coefficients. The results correlated well with the predicted effect of temperature upon the two film coefficients. The liquid film coefficients were significantly lower than those predicted for the system by Sherwood-Holloway correlation. As with the chlorine-water system, the explanation for this difference appeared to lie in the relative rates of diffusion and hydrolysis of the sulfur dioxide within the liquid film. Pseudoliquid film coefficients, calculated assuming no hydrolysis within the film, were in excellent agreement with the predicted values. It was concluded that the overall coefficients are reliable for use in design under the conditions for which they were determined. (Author summary modified)

1991

APTIC NUMBER 18141

Wilson-Jones, R. A.
ENGINES. Automobile Eng. (London), 59(5):200-208, May 9, 1969.

New developments concerning exhaust emission regulations are reviewed. The value, feasibility, and applications of overhead camshafts, afterburners, and spheroidal graphite iron crankshafts on new engines are considered. The apparently simple solution of combining the engine with the cleanest possible exhaust and adding an afterburner may be unfeasible because afterburners of the flame type function best with an appreciable level of fuel, hydrocarbon or CO in the exhaust. New overhead camshaft units of varying characteristics are being employed by different companies. Other changes taking place in the automotive industry are highlighted.

1992

APTIC NUMBER 18124

Yagi, Shizuo, Kazuo Nakagawa, Akira Ishizuya, and Yasuhito Sato
HONDA DESIGNS TWO DEVICES FOR SMALL-ENGINE EMISSION CONTROL. S.A.E. (Soc. Automot. Engrs.) J., 77(8):40-42, August 1969. 1 ref.

Small displacement engines are particularly sensitive to dirty exhausts occurring during abrupt deceleration or gear change. Two emission control systems have been developed for such operating conditions: The "tandem throttle valve" and the "throttle opener" systems. The tandem throttle valve restricts the flow of fuel from the low-speed carburetor system and prevents the fuel remaining on the intake manifold wall from flowing into the cylinders. It provides for complete burning of the fuel not restricted from flowing into the cylinders by adding secondary air. The throttle opener system causes the fuel to burn completely in the cylinder, but without restricting the fuel flow.

1993

APTIC NUMBER 20024

Yeselev, I. M., I. P. Mukhlenov, and D. G. Traber

USE OF IRON CATALYST IN THE CONTACT-TOWER PROCESS. (K voprosu ispol'zovaniya zheleznogo katalizatora v kontaktno-bashennom protsesse). Text in Russian. Zh. Prikl. Khim., vol. 37:722-727, Jan.-April 1964. 22 refs.

Equations were verified for calculating the contact time of gas on an iron catalyst that were sufficient to yield a given degree of conversion. Sulfur dioxide was oxidized over a stationary iron catalyst layer with a grain size of 0.75 mm. The gas flow rate was 0.975 m/sec and rate constants were determined over the range 610-730 C. Estimations of the energy of activation were about 126 kJ/mole for temperatures above 640 C, and 280 kJ/mole below 640 C. The discountinuity at 640 C is explained by the conversion of active ferric oxide to the inert sulfate. The literature is reviewed with respect to the reaction kinetics for SO2 absorption on an iron catalyst with both stationary and fluidized beds.

1994 APTIC NUMBER 20824

Yocom, John E. and Richard A. Duffee
CONTROLLING INDUSTRIAL ODORS. Chem. Eng., 77(13):160-168, June 15, 1970. 22 refs.

Various methods for controlling odors from industrial sources are discussed. Odorous emissions can be reduced by controlling the process temperature, pressure, ventilation, and maintenance. Destruction by flame is the most certain and most flexible method of odor control. Afterburners have been applied to many processes. A temperature of 1200 F in the presence of excess air is needed to completely destroy odors. Combustion with air on catalyst surfaces reaches completion at lower temperatures and is flameless. It has many limitations, however, and should be applied only after pilot tests. Many organic gases are converted to odorless compounds by chemical oxidation using oxidants such as chlorine, chlorine dioxide, ozone, or potassium permanganate. Many odorants can exist as liquids under ambients conditions; cooling such vapors can remove much of the odor by simple condensation. Absorption is used to remove soluble inorganic gases such as hydrogen chloride and ammonia. Organic gases and vapors can be removed from air streams by adsorption with activated carbon. Many odors can be controlled by dilution at the source of emission. The costs of these various control methods are also discussed.

# MEASUREMENT METHODS

1995 APTIC NUMBER 20070

Adams, D. F., M. Corn, C. L. Harding, J. B. Pate, A. L. Plumley, F. P. Scaringelli, and P. F. Urone
TENTATIVE METHOD OF ANALYSIS FOR SULFUR DIOXIDE CONTENT OF THE ATMOSPHERE (COLORIMETRIC). Health Lab. Sci. Suppl., 7(1):4-12, Jan. 1970. 14 refs.

A method of analyzing sulfur dioxide in air entails the aspiration of a measured air sample through a solution of potassium or sodium tetrachloromercurate (TCM). Absorption of SO2 in the solution results in the formation of a dichlorosulfitomercurate complex that is resistant to oxidation. Ethylenediaminetetraacetic acid disodium salt (EDTA) is added to the solution to complex heavy metals that can oxidize SO2 before formation of the dichlorosulfitomercurate. After the absorption is completed, any ozone in the solution is allowed to decay. The liquid is first treated with a solution of sulfamic acid to destroy the nitrite anion formed from the absorption of nitrogen oxides present in the atmosphere. It is next treated with solutions of formaldehyde and specially purified pararosaniline containing phosphoric acid to control pH. Pararosaniline, formaldehyde, and the bisulfite anion react to form intensely colored pararosaniline methyl acid which behaves as a two-color pH indicator. The color is measured with a spectrophotometer or colorimeter capable of measuring at 548 or 575 nm. The lower limit of detection of SO2 in 10 ml of TCM is 0.3 microliters, representing 0.01 ppm SO2 in an air sample of 30 liters. The method is applicable to lower concentrations if the absorption efficiency of the particular system is determined. Calibration procedures and methods of preparing standard SO2 concentrations are detailed.

1996 APTIC NUMBER 18203

Agranov, Kh. I., M. A. Nekrashevich, V. N. Parfenov, and L. V. Reiman
DETERMINATION OF MICROCONCENTRATIONS OF NITROGEN OXIDES IN FL5501 GAS ANALYZER (EXCHANGE OF EXPERIENCE). Ind. Lab. (USSR) (English translation from Russian of: Zavodsk. Lab.), 34(12):1743-1744, Dec. 1968. 3 refs.

Nitrogen oxides with concentrations of 0.0005-0.005 mg/liter and 0.001-0.01 mg/liter were determined automatically on the FL5501 tape photocolorimetric gas analyzer using the reaction between nitrogen dioxide and an indicator. Indicator mixtures were given for both reactions. The optimum flow rate for the gas mixture through the analyzer was 0.15 liter/min. Variations of + or - 10% in the flow rate caused variations of + or - 5% in the results. The analyzed gas reacted on a chromatographic paper strip forming clear pink spots with maximum absorption at 538 nm. A diagram of the instrument used to calibrate the gas analyzer against nitrogen oxide was described. The gas analyzer readings are not a linear function of nitrogen oxide concentration. However, the electrical circuit of analyzer was provided with regulating elements which produced corrected linear output characteristics.

1997 APTIC NUMBER 20038

Akul'shina, L. G., V. N. Aref'ev, N. K. Nikiforova, and G. I. Shchelchkov.
PHOTOELECTRIC DEVICE FOR MEASURING SPECTRA AND CONCENTRATIONS OF LIQUID AEROSOL PARTICLES. (Fotoelektricheskiy pribor dlya izmereniya spektra i kontsentratsii zhidkikh chastits aerozolya). Text in Russian. Tr. Inst. Priklad. Geofiz. (Leningrad), no. 7:41-48, 1967. 4 refs.

A photoelectric sensor capable of determining the size of liquid aerosol particles in the 1-15 micron range at concentrations up to 1000/cu cm is described. This device, called the Aelita and based on the well-known Gucker optical scheme, is used in combination with an AI-100-1 amplitude analyzer. Instrument optics and electronics are described in detail, and a calibration curve and sample spectrum are presented.

1998 APTIC NUMBER 20083

Asakuno, K., T. Yamamoto, and Y. Shinozaki
STUDIES ON AIR POLLUTION BY RADIOACTIVATION METHOD. (Hoshakabunsekiho ni yoru taikiosen no kaiseki). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):28, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

By measuring the particulate pollutants in the atmosphere by means of a radioactivation method, their diffusion mechanism was analyzed based on their time variation pattern. The sources and the development mechanism of the pollutants were also investigated by the distribution of characteristic particle sizes of various matter obtained through the use of an innovative model of a cascade impactor developed by Junge. The observations were performed at three different altitudes on the Tokyo Tower. Manganese and SO2 gas, in addition to bromine and NO2, have high correlations with each other.

1999 APTIC NUMBER 20175

Bakhtiyarov, V. G.
EFFECT OF MULTIPLICITY AND COHERENCE OF SCATTERING ON THE DETERMINATION OF PARTICLE SIZE BY THE TRANSPARENCY METHOD. (Vliyaniye mnogokratnosti i kogerentnosti rassenyaniya na opredeleniye razmerov chastits metodom prozrachnosti). Text in Russian. Tr. Nalchik. Vysoko. Geofiz. Inst., no. 8:49-56, 1968. 4 refs.

Seven plane dispersed-system models, comprised of silver halide particles, were studied in gelatin with particle dispersion ranging from 10,000 to 60,000 particles per sq cm. Maximum transparency for all of these models fell in a relatively narrow band of wave numbers ranging 0.14-0.16/mu. The effect of multiplicity and coherence of scattering is evaluated on the assumption that all particles of the model are equal in size to

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the distribtuion model. Absolute deviation between measurements made of photomicrographs and calculated spectra did not exceed 10 percent for any of the models, but determination of the polydisperse scattering coefficient at concentrations below 50,000/sq cm is difficult, since values approach those of experimental error. Application of the transparency method is limited to systems with minimum particle concentration of 10,000-50,000/sq cm by the accuracy of photometry. Error analysis shows that comparison between calculated data using the transparency method and photomicrography results is achieved with an accuracy of 10-15%.

2000 APTIC NUMBER 20230

Balabuyev, A. G., and A. Z. Makharashvili
INVESTIGATION OF AEROSOLS IN THE FREE ATMOSPHERE BY PLANE. (K voprosu ob issledovanii aerozoley v svobodnoy atmosfere s pomoshch'yu samoleta). Text in Russian. Soobshchen. Akad. Nauk Gruz. SSR, 52(3):639-644, 1968. 7 refs.

Laboratory and flight tests of an airborne air-sampling device designed and built by the Atmospheric Physics Branch of the Georgian SSR Academy of Sciences are reported. This device, which is described in the collection Fizika oblakov (Physics of Clouds), 1967, was proven effective for making detailed and accurate aerosol measurements in flights at altitudes of 1000 and 2000 meters over the city of Tiflis in 1965.

2001 APTIC NUMBER 11623

Barrett, William J.
IDENTIFICATION OF ORGANIC COMPOUNDS IN THE ATMOSPHERE. (SUMMARY REPORT). Southern Research Inst., Birmingham, Ala., Grant AP 00454, Proj. 1791, Rept. 1, 16p., Dec. 27, 1968. 8 refs.

A technique is described for concentrating traces of oxygenated organic compounds in air. The method depends upon the use of a 0.125 by 6-inch copper tube filled with an ordinary gas chromatographic column packing. When a sample of approximately 1000 ml of polluted air is pumped through the tube with a rubber aspirator bulb, a sufficient quantity of pollutants is absorbed for subsequent detection and identification by gas chromatography with a hydrogen flame detector. The limit of sensitivity is estimated to be about 5 ng/l. Application of the method to samples collected at 17 Birmingham locations resulted in the tentative identification of about 30 oxygenated organic compounds. (Author abstract modified)

2002 APTIC NUMBER 17975

Belyaev, S. P.
ASPIRATION OF AEROSOL SAMPLES FROM A FLOW WITH ZERO INTAKE PIPES. (Ob aspiratsii prob aerozolya iz potoka nulevymi zabornymi trubkami). Text in Russian. Tr. Inst. Priklad. Geofiz. (Leningrad), no. 7:74-82, 1967. 9 refs.

Studies of one type of so-called 'zero intake pipe' have established a calibration method which accurately maintains isokinetic characteristics during sampling. In addition to the isokinetic coefficient K (for zero difference between static pressures measured in the flow and in the pipe), coefficient m is determined which takes into account the shape of the pipe. A correction equation is presented which permits maintaining the flow rate inside the pipe equal to the speed of the incoming flow when K is not equal to zero. The feasibility of measuring the dynamic pressure head of the incoming flow for substitution in the above-mentioned equation and for dynamic orientation of the intake pipe relative to the incoming flow is demonstrated. A sample is treated to examine the dependence of K (0.2 to 2.4) on incoming flow rate (5 to 19 m/sec), Reynolds number (1000 to 15,000), and angle of inclination (0 to plus or minus 60 deg) of pipe to the flow direction. Conditions are found in which K changes little with a change in incoming flow rate. Equations are also given for selecting dimensions for zero intake pipes of this type.

2003 APTIC NUMBER 20224

Boyer, A. E. and F. B. Kaylor
COMPUTER SIMULATES URBAN ATMOSPHERES. Power, 113(9):60-61, July 1969.

A new computer program named DOSAGE which analyzes the influence of power-plant emissions on the overall pollution picture was described. The program simulates the behavior of the city's atmosphere. Two groups of variables form the computer input; one for simulating the atmosphere, the other for defining the pollutant. Simulated variables consist of latitude, longitude, meridian, wind speed and direction, air temperatures, cloud cover, and ceiling. Pollutant input variables consist of stack gas flow rate, temperature at stack exhaust, pollutant concentration in the fuel, fuel fire rate, and collector efficiency. Although the program is tailored to work with sulfur dioxide emissions in the urban atmosphere, any kind of pollutant in any location can be treated. Results generated by the computer are generally within 10% of the measured values. The questions the computer program answers are where and how many hours peak concentrations occur each year, how the total annual duration of peak concentrations change if a pollution source is eliminated or controlled, how often a pollutant reaches significant concentrations at a specific point, and how the atmosphere is affected when load on a power plant is changed.

2004 APTIC NUMBER 20790

Brar, S. S., D. M. Nelson, J. R. Kline, P. F. Gustafson, E. L. Kanabrocki, C. E. Moore, and D. M. Hattori
INSTRUMENTAL ANALYSIS FOR THE TRACE ELEMENTS PRESENT IN CHICAGO AREA SURFACE AIR. J. Geophys. Res., 75(15):2939-2945, May 20, 1970. 4 refs.

On April 4, 1968, surface air particulates were collected on cellulose fiber filters simultaneously at 22 different locations throughout the Chicago metropolitan area. A 1-sq cm portion of each filter was irradiated with thermal neutrons in a CP-5 research reactor. The neutron-induced nuclides were analyzed by

gamma-ray spectrometry with 10.2 cm by 10.2 cm (4 in. by 4 in.) and 7.6 cm by 7.6 cm (3 in. by 3 in.) cylindrical NaI(Tl) crystals and a 400-channel analyzer. By varying the neutron flux and the time of irradiation, twenty trace elements in the surface air were detectable by purely instrumental means. The following elements, listed in decreasing order of concentration, were present: iron, chlorine, aluminum, zinc, manganese, sodium, bromine, vanadium, chromium, antimony, mercury, selenium, cerium, silver, cobalt, lanthanum, scandium, cesium, and europium. The average concentrations varied from 2400 to 0.12 ng/cu m air. Calcium concentrations in air were not quantitated. (Author abstract modified)

2005 APTIC NUMBER 20866

Brocco, D., V. Cantuti, and G. P. Cartoni
DETERMINATION OF POLYNUCLEAR HYDROCARBONS IN ATMOSPHERIC DUST BY A COMBINATION OF THIN-LAYER AND GAS CHROMATOGRAPHY. J. Chromatog., 49(1):66-69, May 20, 1970. 3 refs.

A procedure for analyzing polynuclear hydrocarbons contained in atmospheric dust combines the best properties of both thin-layer and gas chromatographic techniques. There are the ability of thin-layer chromatography to isolate and purify the sample and the high sensivity and resolution of gas chromatography to separate and evaluate each single constituent. The dust, or a cyclohexane extract, is applied on a silica gel plate and developed with cyclohexane-benzene (1:1.5). In this way, the polynuclear hydrocarbons are separated from paraffins, heterocyclics, etc. The part containing polynuclear hydrocarbon is extracted again and examined by gas chromatography on a glass capillary column. Both quantitative and qualitative results obtained for some polynuclear hydrocarbons by the procedure are tabulated. (Author abstract modified)

2006 APTIC NUMBER 20830

Carnuth, W.
AEROSOL SIZE DISTRIBUTION AT 700-, 1800-, AND 3000-METER ALTITUDES. J. Geophys. Res., 75(15):2999-3005, May 20, 1970. 8 refs.

Simultaneous measurements of aerosol size distribution were made at three mountain stations at 700, 1800, and 3000 meters with five-stage Casella impactors. The measured aerosol size distributions were analyzed according to air-mass type, vertical mixing activity, and amount of fog and precipitation. The lowest particle concentrations were found in polar maritime air which may be attributed to the high incidence of precipitation in this air mass and the short duration of its contact with land. Various degrees of vertical mixing activity did not affect the size distribution and concentration of aerosols as much as was expected. Within fog, distinctly lower particle concentrations were observed than for fog-free air which applies especially to the large particles. Washout of particles by precipitation is more pronounced at high levels than near the ground. The relationship between precipitation and aerosol distribution is increasingly reliable for an increasing distance between the observation site and local aerosol sources. (Author abstract modified)

2007 APTIC NUMBER 20212

Caruyno, Nicola
DETERMINATION OF PARAFFIN WAXES OF TOBACCO AND TOBACCO SMOKE BY GAS-LIQUID CHROMATOGRAPHY. Nat. Cancer Inst. Monograph, no. 9:171-181, 1962. 14 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

An analysis of paraffinic hydrocarbons in tobacco and tobacco smoke revealed the presence of alkanes with 8-24 carbon atoms in tobacco and with 15-33 carbon atoms in tobacco smoke. The experiment demonstrated that high temperature gas-liquid chromatography can be used to identify and quantitatively determine the paraffin in tobacco and tobacco smoke; that lighter paraffinic hydrocarbons are present, along with considerable quantities of isoparaffins; and that complete analysis is rapid, with no need for any fractionation of paraffin waxes in order to determine single paraffinic hydrocarbons.

2008 APTIC NUMBER 20806

OZONE REACTIONS PRODUCE SINGLE OXYGEN. Chem. Eng. News, 48(19):34, May 4, 1970.

An experimental procedure for identifying singlet oxygen, a high-energy excited form of molecular oxygen, indicates that it is produced by the ozonization of isopropyl ether and isopropyl alcohol. The ozonization of isopropyl apparently proceeds through a hydrotrioxide intermediate rather than through an ether-ozone complex. Ozone was added at low temperatures to isopropyl ether followed by the generation of oxygen in a separate step. An acceptor, such as tetraphenylcyclopentadienone (tetracyclone), is then added to detect singlet oxygen, and the solution is slowly warmed until the intermediate decomposes to release oxygen. Tetracyclone, which is highly colored, is completely bleached as it reacts with singlet oxygen to form cis-dibenzoylystibene. By measuring the decrease in absorbance at 510 Nm, 21.4% of the oxone absorbed by isopropyl ether is available to bleach tetracyclone. With isopropyl alcohol, only 3.13% is available.

2009 APTIC NUMBER 20021

Commins, B. T.
INTERIM REPORT ON THE STUDY OF TECHNIQUES FOR DETERMINATION OF POLYCYCLIC AROMATIC HYDROCARBONS IN AIR. Nat. Cancer Inst. Monograph, no. 9:225-233, 1962. 14 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

The efficiency and reliability of air pollution sampling equipment was subjected to a series of tests, which included losses and collection efficiency of polycyclic aromatic hydrocarbons at room temperature and higher temperatures; stability of samples after collection; losses of pure benzo(a)pyrene and pyrene when these are collected by means of a paper filter; and the polycyclic aromatic hydrocarbon vapor content of the air. Samples collected over long periods, especially at high temperatures, tend to lose some of their hydrocarbons content. Samples kept in the

laboratory for as little as 3 weeks can be altered, but cyclohexane extracts of smole samples are fairly stable. An attempt to demonstrate the vapor phase of fluorescent polycyclic aromatic hydrocarbons in urban air (81.6 cubic meters of air aspirated through liquid paraffin for 38 days) was unsuccessful. The use of a narrow baseline (5-8 millimicrons) improves reliability in spectrophotometric procedures.

2010 APTIC NUMBER 17928

Dupire, Fernand
ANALYSIS OF COAL TAR PRODUCTS BY HIGH-TEMPERATURE GAS CHROMATOGRAPHY. Nat. Cancer Inst. Monograph, no. 9:183-191, 1962. 14 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnati, Ohio, Aug. 29-31, 1961.)

Gas chromatography has been used since 1957 to study coal tars and their derivatives. A simple apparatus, constructed of pyrex glass and including catharometers equipped with tungsten wire sensors, permits work at temperatures plus or minus 400 C. Silicon grease and polyester are used as stationary phases, the choice of which has permitted analysis of the volatile components of hard pitch, including unidentified products that boil at temperatures of 600-700 C. The techniques are recommended for analysis of heavy aromatic hydrocarbons, such as polynuclear compounds with as many as 7 rings. It is expected that the introduction of capillary columns and temperature-programmed chromatography will improve the present potentialities of the method.

2011 APTIC NUMBER 20102

Eltinge, Lamont
FUEL-AIR RATIO AND DISTRIBUTION FROM EXHAUST GAS COMPOSITION. SAE (Soc. Automotive Engrs.) Trans., 77(1):425-450, 1969. 15 refs. (Paper 680114.)

Charts were developed from the composition of gasoline-engine exhaust which indicate quickly and easily the fuel-air ratio of the mixture inducted into the engine, uniformity of mixture distribution and completeness of combustion, and internal consistency of the set of exhaust-composition measurements. The charts relate exhaust to the weight ratio of fuel to total dry air, F/A, and they were constructed for fuels with hydrogen-carbon atom ratios of 1.14 (toluene), 1.8 (relatively aromatic commercial fuel), 1.9 (Indolene), 2.0 (olefins, cycloparaffins, and relatively paraffinic commercial fuel), and 2.25 (isooctane). The contribution of unburned hydrocarbons (Fu) must be recognized and can be incorporated in one of two ways: by adjusting O2, CO2, and CO before determining the ratio of total fuel (Ft) to dry air (Ft/A); or by correcting the ratio of fuel burned to dry air Fb/A for unburned fuel (Fu/A) to determine (Ft/A).

2012 APTIC NUMBER 20002

Ettinger, Harry H. and George W. Royer
CALIBRATION OF A TWO-STAGE AIR SAMPLER. California Univ., Los Alamos Scientific Lab., N. Mex., AEC Contract W-7405-ENG. 36, LA-4234, 7p., Aug. 1969. 22 refs.
CFSTI: LA-4234

Although the 10-mm nylon cyclone sampler, followed by a high efficiency filter, is ideally suited for evaluating the hazards of inhaling radioactive or toxic materials, there is disagreement as to the proper flow rate for the sampler. This is partially due to using different definitions of particle size in previous calibrations. In the present investigation, the collection efficiency of the miniature nylon cyclone for monodisperse aerosols was studied as a function of particle aerodynamic diameter and cyclone flow rate. Good estimates of respirable dust were obtained when the sampler operated at a flow rate of 1.7 l/min. It is concluded that the recommended rate of 2.8 l/min is in error because it is based on the microscopic diameter of irregularly shaped particles.

2013 APTIC NUMBER 12251

Fang, C. S. and H. William Prengle, Jr.
INFRARED EMISSION SPECTROSCOPY-RADIATION FROM HOT GASES (IRES PROJECT). (PROGRESS REPORT). Houston Univ., Tex., Thermodynamics and Kinetics Research Lab., 61p., Aug. 1, 1968. 26 refs.

The development of instrumentation for measurements of atmospheric pollutants in chimney stack plumes is presented, together with a compilation of existing data on infrared spectra of carbon monoxide, carbon dioxide, water, nitrogen dioxide, nitric oxide, and sulfur dioxide; definitions of the monochromatic absorption coefficient and monochromatic emissive power; and the integrated intensity and the mean absorption coefficient within a given wave-number band. An analytical expression is derived for the energy flux, Q, of radiation within a given wave-number band, emitted by a gas species of a given temperation and partial pressure contained in spherical envelope of radius R which is intercepted by the sensing area, A, of the receiver located at a distance L greater than or equal to R from the center of the envelope. A computer program for calculation of Q/A in the simpler special case when L equals R is given. A compilation of air-pollution data, primarily for American cities, is followed by a review of the Final Reports of two projects relating to infrared techniques of monitoring stack gases and a series of critical comments. The possibility of using the CO2 content of the stack gas as a basis of comparison for contents of the other gas species as well as to calculate the temperature of the stack plume is mentioned.

2014 APTIC NUMBER 18190

Fredericks, E. M., and G. A. Harlow
DETERMINATION OF MERCAPTANS IN SOUR NATURAL GASES BY GAS LIQUID CHROMATOGRAPHY AND MICROCOULOMETRIC TITRATION. Anal. Chem., 36(2):263-266, Feb. 1964. 12 refs.

A method is described for determining and identifying individual mercaptans in natural gas that contains large amounts of hydrogen sulfide. It utilizes a standard gas-liquid chromatograph coupled with a commercially available microcoulometric titrator. The

sample components are separated on the chromatographic column and the individual mercaptans titrated automatically with coulometrically generated silver ion as they emerge. The large excess of hydrogen sulfide is bypassed and not determined. The method requies only 30 ml of sample and is rapid (1 hour), precise (+ or - 2% at 50 ppm), and sensitive to as little as 1 ppm of an individual mercaptan. One source of possible error might occur in the analysis of large amounts of volatile materials which could escape from the acidic titration solvent before reacting with the silver. These large fractions would be indicated by flat tops on the chromatograph. This requires smaller samples or slower flow rates. A major advantage of the technique is that it is an absolute method where the chromatograph alone would have to be calibrated against standards.

2015 APTIC NUMBER 16175

Puwa, Keiichiro, and Bert L. Vallee
A MULTICHANNEL FLAME SPECTROMETER. I. INSTRUMENTAL DESIGN. Anal. Biochem., 17(3):444-455, Dec. 1966. 16 refs.

A direct-reading multichannel flame spectrometer has been built with the following specific features: (1) simple optics eliminate collimating mirrors, providing a simple, steady mounting that enhances light intensity. (2) symmetrically identical spectra are obtained at either side of the entrance slit placed normal to the grating, providing ample space for mounting multiple-exit slits and photomultiplier assemblies. (3) astigmatic lines serving to cancel nonuniformity of the flame source. The spectrometer has been successfully and routinely used for the measurement of Na, K, Ca, and Mg. The results obtained with the instrument indicated that with a flame emission source a detection sensitivity of 0.5 micrograms/ml was easily obtained, and a sensitivity up to 1000 micrograms/ml could be obtained with simple adjustments. The use of the apparatus is not limited to that of an emission flame spectrometer. It can be adapted for atomic absorption measurement simply by placing a hollow cathode lamp behind the flame.

2016 APTIC NUMBER 11681

Geary, H., G. Ohring, R. Lilienfeld, and W. Shenk
AEROMETRY INSTRUMENTATION STUDY. (FINAL REPORT). GCA Corp., Bedford, Mass., Technology Div., Propulsion Lab. Contract 951954, GCA-TR-68-12-G, p. 222-274, Sept. 1968. 41 refs.
CFSTI: N69-10163

Techniques and instrumentation are described for interplanetary missions to measure atmospheric light transmission, and beta radiation absorption, and to make light scattering analyses, television particle analyses, acoustic attenuation analyses, and charged-particle mobility analyses. Heated filament liquid-particle detectors and the Coulter particle counter are also mentioned. Each of these topics is treated separately with individual bibliographies.

2017 APTIC NUMBER 20815

Gelpi, E. and J. Oro
UBIQUITY OF HYDROCARBONS IN NATURE: GAS CHROMATOGRAPHIC-MASS SPECTROMETRIC DETERMINATION OF THE HYDROCARBONS IN CIGARETTE SMOKE CONDENSATE. Chromatog. Sci., vol. 8:210-213, April 1970. 20 refs. (Presented at the National American Chemical Society Meeting, 157th, Symposium on Plans for the Chemical Analysis of Returned Lunar Samples; Minneapolis, Minn., April 13-18, 1969.)

The alkane content and the nature of cigarette smoke were investigated by a gas chromatographic-mass spectrometric method. The smoking operation was conducted in a vacuum system. The smoke was condensed in a trap cooled with liquid nitrogen. The condensate was collected by washing the trap with n-pentane. It was then fractionated on a silica gel column and treated for analysis. A relatively high amount of paraffins and olefins ranging from C(10) to C(33) were identified. The paraffins showed a predominance of the odd carbon numbered chains, and a bimodal distribution with maxima centered below C(12) and at C(31). The olefins showed a predominance of the even numbered carbon chains. Two series of methyl alkanes were also identified. In the high molecular weight region, the anteiso alkanes with an even number of carbon atoms predominated over the corresponding isoalkanes. The odd-numbered iosalkanes predosinated over their anteiso homologs. The smoke also contained large amounts of C(19) and C(20) isoprenoid olefins. The C(15), C(18), C(19), and C(20) isoprenoids were present in decreasing concentrations. (Author abstract modified)

2018 APTIC NUMBER 20186

Gol'berg, M. A.
MEASURING THE RANGE OF VISIBILITY IN DARK DIURNAL TIME BY BACKWARDS DIFFUSION. (Izmereniye dal'nosti vidimosti v temnoye vremya sutok po rasseyaniyu nazad). Tr. Inst. Fiz. Atm. Akad. Nauk SSSR, 1964:206-209, 1964. 8 refs. Translated from Russian by L. Marokus, Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., FTD-HT-23-588-67, 5p., Sept. 15, 1967.
CFSTI: AD 676224

Field tests were made with the NUOR, a nephelometric instrument based on a backscattering principle, to determine the visibility range at night by recording the scattering at an angle close to 180 degrees. The calibration curve for the instrument was constructed by using data from literature and parallel measurements with an M-37 transparency recorder. For the entire range of visibility measured, the NUOR ensures an adequate degree of accuracy. In 898 comparative measurements, there was not a single deviation between the two instruments greater that 90%. In 84% of the cases, the deviations were less than 30%, and in only 4 cases did the deviations exceed 60%. It was concluded that the nephelometric backscattering apparatus can be used for determining the scattering coefficient at angles close to 180 degrees. The scattering index should be determined independently by some other method. Data were given for values of the relative coefficient of scattering for the angles 175-180 degrees, which were averaged for the entire period of observation. (Author abstract modified)

2019 APTIC NUMBER 20178

Golikov, V. I.
ACCURACY OF CALCULATING PARTICLE SPECTRA IN TERMS OF SMALL ANGLES OF THE SCATTERING INDICATRIX. (O tochnosti vychisleniya spektra chastits po malym uglam indikatrisy rasseyaniya). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 223:28-37, 1968. 8 refs.

Application of the method of small angles to determine particle size distribution in aerosol systems such as those present in clouds, fog, and smoke on the basis of photometric measurement of light scattering is examined. Maximum error using the method of small angles is set at 5-10% close to the maximum of the distribution curve, increasing to 25-40% at the base; an error of 1-10% in photometer values is assumed.

2020 APTIC NUMBER 20247

Gonskaya, G. G. and L. B. Chudnova
METHODS OF ANALYZING ORGANOPHOSPHORUS INSECTICIDES (TRICHLOROMETAPHOS AND CARBOPHOS) IN AEROSOL CONTAINERS AND IN AIR. Tr. Tsentr. Nauchn. Issled. Dezinfektsion. Inst., no. 18, Part 3:21-24, 1967. 3 refs. Translated from Russian. Joint Publications Research Service, Washington, D. C., 5p., Sept. 12, 1969.
CFSTI: JPRS 48803

Two methods of analyzing organophosphorus insecticides are described: one for analyzing the insecticides in aerosol containers; the other, for analyzing these in air. The aerosol container method uses the decomposition of the insecticides with nitric and sulfuric acids in the presence of potassium permanganate, and the reduction of molybdic acid to molybdenum oxide, which has a blue color. This in turn reacts with phosphoric acid to yield a complex that has a bright blue color in an acid medium; the color intensity is determined with a photocolorimeter. The air sampling method uses aluminum oxide rather than the usual silica gel. The method is simple, reduces analysis time, and avoids the confusion resulting from the blue coloration from a reaction between silica gel and the reagents used.

2021 APTIC NUMBER 20242

Guthmann, Kurt
DUST CONCENTRATION MEASUREMENTS, COMPARATIVE MEASUREMENTS AND STANDARDIZATION. (Staubgehaltsmessung, Vergleichsmessungen und Standardisierung). Text in German. Arch. Tech. Messen, V 12860(374):63-64, March 1967. 8 refs.

Eight institutes in Germany, France, Italy, The Netherlands, and Austria participated in a comparison of dust concentration measurements developed in the various countries. Eight gravimetrical units and ten particle counters were used at the same place. The results from gravimetrical dust measurements showed good agreement, taken with various units in the large dust sphere in Le Bouchet near Paris. The measured concentrations differed no more than + or - 10%. The results obtained with the particle counters were not comparable. The great variation of these results was mainly due to the use of different types of microscopes and different enlargements.

2022 APTIC NUMBER 18195

Hilado, Carlos J.
SMOKE FROM CELLULAR POLYMERS. Fire Technol., 5(2):130-139, May 1969. 30 refs.

The density of smoke produced by a variety of natural and synthetic cellular polymers (e.g., wood, rubber, urethane, polyethylene) now used in buildings, automobiles, and aircraft was studied. Smoke produced by the incomplete burning of a polymer consists of a cloud of solid particles, fragments of partially burned polymer broken off and swept along with the expanding combustion gases. The Natural Bureau of Standards smoke test and the Rohm and Haas XP2 smoke density test are described in detail. In the latter test, smoke density data exhibited a wide range of values, the values of each material varying with exposure conditions and specimen size. Among the synthetic polymers, phenolic polymers and polyethylene showed the lowest smoke density and rubber and polyvinyl chloride the highest.

2023 APTIC NUMBER 20253

Hunter, Richard S.
HIGH RESOLUTION GONIOPHOTOMETER AND ITS USE TO MEASURE APPEARANCE PROPERTIES AND LIGHT-SCATTERING PHENOMENA. In: Modern Aspects of Reflectance Spectroscopy. Wesley W. Wendlandt (ed.), New York, Plenum Press, 1968, p. 226-241. 5 refs.

A goniophotometer is a multipurpose instrument for measuring and plotting automatically those aspects of object appearance associated with the geometric manner in which the object reflects or transmits light; it measures geometric properties in the same way a spectrophotometer measures spectral properties. A current model of the instrument includes an optical unit with fixed and movable beams, a control panel, and a recorder on which goniophotometirc curves are plotted directly as samples are scanned. The reference standard normally used is the ideal perfect white diffusor, i.e., a white which reflects and diffuses completely. The development, design, and applications of the apparatus are reviewed, and sample curves are given. In addition to its use in appearance measurement, the instrument is of interest in product identification, since goniophotometric light scattering measurements for chemical identification are spectrally different and closely controlled as to wavelength. A further potential application is for light scattering measurements, although no data on such use are now available.

2024 APTIC NUMBER 20100

Hurn, R. W. and W. F. Marshall
TECHNIQUES FOR DIESEL EMISSIONS MEASUREMENT. SAE (Soc. Automotive Engrs.) Trans., 77(2):1492-1501, 1969. 10 refs. (Paper 680418.)

The differences between diesel and gasoline exhausts result primarily from differences between characteristics of the air/fuel mixtures inherent in the respective combustion cycles; in addition, physical states are markedly different between the two engine types. The diesel engine operates with its air-intake unthrottled. The concentrations of the material to be measured are lowered as a result of dilution by the excess air and, with an appreciable quantity of oxygen in the hot exhaust gases, post combustion oxidation may occur to introduce problems in preserving sample integrity. Diesel mixture is heterogeneous with infinite variation in fuel richness throughout the combustion zone. Hydrocarbon is determined by a flame ionization technique in which a heated detector and sampling system are essential, but difficulties are encountered in sampling control, absolute calibration, and probable nonuniform response to different hydrocarbon species. High resolution gas chromatography is the only means by which the complex mixture of hydrocarbon in diesel exhaust can be determined in any detail. The technique for total oxides of nitrogen involves the sum of nitric oxide and nitrogen dioxide determined separately by nondispersive infrared and ultraviolet methods, but results are subject to uncertainty due both to loss of NO2 and to product reaction. Formaldehyde is determined by the chromotropic-acid procedure, and other aldehydes are determined using a modified version of the 3-methyl-2-benzothioazolone test. While the absolute values from determinations by these methods are not considered reliable, useful information is available from relative values and directional changes that they may indicate. Diesel smoke is determined using a light extinction smokemeter as specified in Federal standards for 1970 vehicles or, alternatively, using the specified instrument fitted with a smoke tube in a closed smoke conductor circuit. No instrumental or analytical procedure is useful in evaluating diesel odor, but a human panel is used for subjective measurement, and observations are referred to standard reference materials.

2025 APTIC NUMBER 12250

Innes, W. B. and A. J. Andreatch
CHARACTERIZATION OF PETROLEUM WASTE PRODUCTS BY SELECTIVE COMBUSTION THERMAL EFFECTS. American Chemical Society, Washington D. C., Symp. Ap. Chem. Soc. Develop. Petrol. Environ. Chem., San Francisco Calif., 1968, p. E11-E25. 6 refs. (April 2-5.)

An instrument was developed for independently measuring both carbon monoxide and hydrocarbons in auto exhausts. For hydrocarbon analysis, water saturated air supplied by the aquarium pump and water saturator continuously flows through the storage coil and into the preheater and catalyst bed at a fixed rate of about 1 liter/min. A syringe port is used for injecting a 25-50 ml sample in 3-8 sec into the air stream. Constant flow is maintained during injection by the action of the water bubbler. The hydrocarbons in the sample are oxidized by the catalyst as they flow through the bed resulting in a temperature rise which is detected by differential temperature probes, amplified by the electrical system, and read out on a meter or recorder to an accuracy of about 0.01 C. The principle and apparatus employed for carbon monoxide measurement is the same as for hydrocarbon analysis, except that a Hopcalite oxidation catalyst and a charcoal scrubber (5 cc) are used before the reactor to remove interfering hydrocarbons. The flow split with lesser flow to the CO unit, together with the volume of charcoal scrubber, serves to delay the CO peak until after the HC peak so that both measurements can be conveniently read on the same readout system by proper switching. Tests with the analyzer showed that it is well suited for analysis of CO and HC and should be a useful tool for economically correcting improper engine operation. It can be tailored either to correlate with current flame ionization or infrared techniques or with probable future standards based on photochemical reactivity.

2026 APTIC NUMBER 20009

Jackson, Peter J., Walden E. Langdon, and Peter J. Reynolds
AUTOMATIC CONTINUOUS MEASUREMENT OF SULFUR TRIOXIDE IN FLUE GASES. Preprint, American Society of Mechanical Engineers, New York, 9p. 1969. 5 refs. (Presented at the American Society of Mechanical Engineers., Winter Annual Meeting, Los Angeles, Calif., Nov. 16-20, 1969, Paper 69-WA/APC-2.)

A new industrial instrument for continuous sulfur trioxide measurement in combustion gases is capable of automatic operation remote from the control and registration position. Components of the instrument are a sampling system and chemical analyzer and supply, control, alarm, and registration facilities. The principle of operation is the absorption of sulfur trioxide in an aqueous solution of isopropanol, reaction of the sulfate ions with solid barium chloranilate, and the photometric determination of the acid chloranilate ion. A response time of about 1 min and a sensitivity range of 0.02 to 250 ppm make the instrument suitable for most requirements of operational control, plant investigations, and independent research. Simple modifications enable the application of the instrument to be extended to higher and lower SO3 ranges.

2027 APTIC NUMBER 17963

Jacobus, F. B.
PRINCIPLES OF A LIGHT SCATTERING NEPHELOMETER AND APPLICATIONS. Preprint, 10p., 1963. 3 refs. (Presented at the American Association for Contamination Control 2nd Annual Convention, Boston, Mass., April 30 - May 3, 1963.)

A new piece of opto-electronic equipment, based on the principle of 90 degree light scattering, is described. It is used for automatically sizing and counting micron-sized particles in liquid media. The particle counter responds to a particle according to its surface area, and as such sizes the particle on the basis of the mean or average dimension. The standard flow system arrangement permits use of the instrument either as an inline monitor for continuous flow systems or as a small sample analyzer. By use of a pressure feed system to circulate a small sample, repeated measurements may be made on the sample without disturbing the particle balance in the liquid. The particle sensor has a stainless steel flow system for wide range chemical compatibility and will operate at pressures up to 3000 PSI. A test was made with this particle counter using MIL-6083, a deep red liquid of high viscosity. Generally, color in the liquid presents no problems, but there will be a different calibration level associated with each color. Besides red and colorless liquids, the model has been

used successfully with MIL-8515, a high temperature, high viscosity hydraulic fluid with a deep amber color. In colorless liquids, background scattering limits the smallest particle size to 3 micron. A 21% error in count results at a concentration level of 40,000 particles per 100 cc. The error drops to 10% at 20,000; at 10,000 per 100 cc, it is negligible. The instrument can accept liquid input at flows up to .5 gallons per minute, in which case the actual sample rate is 75 cc per minute.

2028 APTIC NUMBER 20246

Khmelevtsov, S. S.
A SIZE-SEPARATION COLLECTOR FOR SAMPLING AEROSOLS FROM CURVILINEAR FLOW. Tr. Astrofiz. Inst. Akad. Nauk Kaz. SSR, vol. 3:108-114, 1962. 5 refs. Translated from Russian. Fort Detrick, Frederick, Md., 9p., Nov. 22, 1967.
CFSTI, DDC: 678123

A collector for sampling aerosol particles with a minimum size of 0.7-0.8 micron, moving in a curvilinear flow, is described, together with a recommended method for analyzing samples and obtaining distribution data. Distribution parameters obtained by the use of this equipment have been checked against microphotographic data and agree. The collector consists of a tube with conifuge, the flow rate of which can be varied from 10 to 25 meters per second. Sampling occurs in a section of the tube the radius of which is 2 mm and the mean curvature, 6 mm. The tube is provided with a gauge capable of regulating the flow rate between 0 and 70 meters per second.

2029 APTIC NUMBER 20808

Klein, Nicholas and Yeshaye Levy
SMOKE CLEANING APPARATUS. (Assignee not given) U. S. Pat. 3,487,620. 6p., Jan 6, 1970. 15 refs. (Appl. Feb. 16, 1968, 1 claim).

Filter screens for removing solid particles from the smoke of incinerator stacks tend to become quickly clogged, reducing the draft required to operate the incinerator effectively. If clogging is to be avoided, the filter mesh is of such coarseness that an excessive amount of solid particles is discharged to the atmosphere. Apparatus is provided for washing the smoke in a draft of steam and draining off the condensed steam which contains the removed particles. The heat of combustion in the incinerator generates steam in a coiled, tubular heat exchanger continuously supplied with fresh water. Steam travels up the stack and impinges on a water-cooled moving screen which travels across the stack. The screen is scrubbed continuously and polluted water containing solid particles is drained off to a sewer. A disinfectant-deodorant, such as ozone, is volatilized in the heat exchanger and discharged with the steam into the smoke. In a modification of the invention, a two-stage smoke cleaning apparatus is provided. Cold water is discharged on a stationary conical screen which catches the solid particles in the smoke, while a field of finely divided streams of cold water is maintained across the stack. Any fine particles in the smoke passing through the streams are caught and carried away to a drain.

2030 APTIC NUMBER 20814

Kusazawa, Y. and Y. Nogami
DETERMINATION OF HEAVY METALS IN AIR BY FLUORESCENT X-RAY ANALYSIS. PART II. (Keiko X-sen bunsekiho ni yoru taikichjukinzoku no sokutei (2)). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):107, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

The removal of high-order lines in fluorescent x-ray analysis requires that the wave height pH be separated out by using the difference in energy of the X-rays. Since the process of readjusting the pH analyzer for different diffraction angles is too involved, continuous analysis has been impossible. A mathematical reformulation was introduced where the pH is inversely proportional to the sin of the diffraction angle so that the apparatus can be modified in order to change the gain automatically by the amount sin of theta for every change in theta. As a result, continuous analysis was possible for metals in dust particles collected by a high-volume air sampler. The error in measurement due to different filter absorption patterns resulting from adding metal chelate solution to the sample material was investigated. Assuming that the pattern is roughly a circular area, the measurement of its radius would enable the calculation of the increase in the intesity of X-ray due to the added metalic elements. The increase in intensity and the radius r have an approximately linear relationship.

2031 APTIC NUMBER 20031

Laktionov, A. G.
COMPARISON OF TWO PHOTOELECTRIC INSTRUMENTS FOR DETERMINING DIMENSIONS AND CONCENTRATIONS OF AEROSOL PARTICLES. (Sravneniye dvukh fotoelektricheskikh priborov dlya opredeleniya razmerov i kontsentratsiy aerozol'nykh chastits). Text in Russian. Tr. Inst. Geofiz. (Leningrad), no. 7:68-73, 1967. 12 refs.

Two instruments designed for the study of aerosol particles are described. The first, the FIChA-K-90, functions to measure light scattering by the aerosol to a 90 degree angle. In the second, the FIChA-K-O, light scattered by the aerosol is measured in the direction of incident illumination. Calibration with oil mist revealed that with droplet sizes above 0.6 micron, the output of both instruments is proportional to the square of the particle size. For particles ranging 4-20 micron, the FICh-A-K-90 yields a signal/noise ratio about 14 times greater than that of the second instrument.

2032 APTIC NUMBER 18180

Langer, G.
STATUS OF ACOUSTIC PARTICLE COUNTER RESEARCH. Powder Technol., 2(5):307-309, June 1969. 8 refs. (Presented at the International Conference on Powder Technology, Chicago, Ill., May 20-23, 1968.)

The acoustic sensor developed at the National Center for Atmospheric Research has recorded large, audible clicks produced

by particles over 20 microns in diameter, the clicks originating as shock waves. An objective of a series of experiments undertaken to learn how the counter works was to locate the point at which a shock wave is formed. In contrast to other studies suggesting that the effect originates in the exit jet and travels up the capillary, the results indicate that the particles must interact with the boundary layer in the capillary to generate shocks. Somewhere along the capillary a particle contacts the boundary layer as it converges into the capillary, producing a 'parcel' of turbulence. The laminar flow that issues into the exit cavity just behind a parcel of turbulence will hit a wall of stationary air, resulting in a reflected shock wave.

2033 APTIC NUMBER 20057

Lorenzo, Aldo Di
TRACE ANALYSIS OF OXYGEN, CARBON MONOXIDE, METHANE, CARBON DIOXIDE, ETHYLENE AND ETHANE IN NITROGEN MIXTURES USING COLUMN SELECTOR. J. Chromatographic Sci., 8(4):224-226, April 1970. 12 refs.

The routine analysis of oxygen, carbon monoxide, methane, carbon dioxide, ethylene, and ethane, when mixed with nitrogen is facilitated by the use of a new column selector using columns made of the porous polymer Porapak Q. The system uses a molecular sieve. Tests were conducted at room temperature with helium as a carrier gas. A molecular sieve column was placed in series with a porous polymer column, eluting the oxygen before the nitrogen, which resulted in higher peaks for the gases being investigated. The column selector, which allows columns to be inserted independently into the gas circuit, is used to prevent contact between the molecular sieve column and the carbon dioxide, ethylene and ethane.

2034 APTIC NUMBER 20804

Luedecke, Heinz-Juergen and Kurt Moldenhauer
EXHAUST GAS SAMPLER. (Hartmann and Braun, A. G., Frankfurt am Main (West Germany)) U. S. Pat. 3,481,200. 4p., Dec. 2, 1969. 3 refs. (Appl. Oct. 1, 1968, 6 claims).

A sampling device for internal combustion motor exhaust gases is described, comprising an articulated probe tube insertable into an exhaust pipe where it is held by a clamp. The exhaust sample than is passed downwardly through a cooler to remove condensable components, then through and across a safety chamber into the lower part of a directly adjacent coarse vertical filter, and upward to a fine filter. Condensable components, mostly water, drain from the cooler and chamber into a siphon trap. The trap is composed of vertical tubes, one within the other, and mounted on a base. Provision is made for easy cleaning of the cooler and quick replacement of filtering media.

2035 APTIC NUMBER 20786

Luft, Karl

INFRA-RED GAS ANALYZER FOR MEASURING THE CONCENTRATION OF A PARTICULAR GAS. (Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux (France)) U. S. Pat. 3,476,934. 5p., Nov. 4, 1969. 3 refs. (Appl. July 27, 1967, 6 claims).

A gas analyzing apparatus measures the concentration of a particular gas in a mixture of gases. Infra-red radiation is passed successively through a sample cell containing the mixture to be analyzed and through two detector chambers arranged one after the other. One of the detector chambers communicates with one side of a variable plate of a variable capacitor. The other detector chamber communicates with the other side of the same plate. The signal, at zero concentration of the particular gas, is compensated by an auxiliary signal produced independently of the signal at zero. (Author abstract modified)

2036 APTIC NUMBER 20222

Lyubimov, N. A.
A NEPHELOMETER WITH AN AUTOMATIC 24-HOUR DEVICE FOR CONTINUOUS RECORDING OF SULFUR DIOXIDE CONCENTRATIONS IN ATMOSPHERIC AIR. In: Limits of Allowable Concentrations of Atmospheric Pollutants, V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 120-127. 12 refs. (Trans'ated by B. S. Levine.)

A 24-hour sulfur dioxide analyzer is described which is based on the principle of photometry and characterized by high sensitivity. The cell for the reagent is made of optical glass. Negative pressure is created in the cell by suction from a continuously operating centrifugal aspirator which causes air to bubble through the reagent solution at 0.5 l/min. The air bubbles create a laminar flow of absorbent fluid favorable for the operation of a photometer equipped with a device for the recording of the solution's reactions to the nephelometric effects of sulfur dioxide. The transmitting system element operates on the principle of a nonequilibriated bridge with two arms equipped with radiant energy receptors and two with ohm resistors. The preferred absorber solution is barium which, because it bears a functional relation to the actual SO2 concentrations, makes evaluation of the recorded graphs comparatively easy. The advantage of the automatic apparatus is that it enables determinations of an average SO2 concentration for any period of time, whether minutes, a full day, or longer. A formula is presented for computing sulfur dioxide concentrations.

2037 APTIC NUMBER 20119

Martens, Stuart W. and Kelly W. Thurston
MEASUREMENT OF TOTAL VEHICLE EVAPORATIVE EMISSIONS. SAE (Soc. Automotive Engrs.) Trans., 77(1):501-511, 1969. 7 refs. (Paper 680125)

Measurement of total vehicle evaporative emissions was achieved using a sealed plastic enclosure consisting of an impermeable envelope that isolates the 'atmosphere' immediately surrounding the test vehicle, while containment of vehicle emissions within a fixed volume allows determination of weight emissions by a

simple hydrocarbon concentration measurement. The SHED (sealed housing for evaporative determinations) facility consists of a sealed enclosure large enough to house a complete car, a small blower for mixing contained gases, a large blower for purging, and a flame ionization hydrocarbon analyzer with associated plumbing and calibration gases. The sealed enclosure measured 39.9 gr from a production car compared with 31.0 gr as measured by charcoal traps, indicating that 8.9 gr escaped through openings other than where the traps were connected.

2038 APTIC NUMBER 20066

Morlin, Zoltan and Magdolna Kertesz-Saringer
STUDIES ON THE ABSORPTION AND FLUORESCENCE OF AROMATIC CARBOHYDROGENS. (Vizsgalatok az aromatikus szenhidrogenk abszorpcioja es fluoreszcenciaja korebol). Text in Hungarian. Egeszsegtudomany, 9(4):349-356, Jan. 1965. 7 refs.

The absorption and fluorescence spectra of the aromatic hydrocarbons are influenced by contamination, particularly by the presence of contaminating hydrocarbons. The absorption analysis of hydrocarbon mixtures can be evaluated, but the fluorescence by the same mixture gives deformed curves. Chromatographized fractions of the soot contamination extracted from the air contain substances which prevent absorption spectra from being evaluated, while barely influencing the fluorescence spectra.

2039 APTIC NUMBER 17999

Municipality of Metropolitan Toronto (Ontario), Dept. of Works - Air Pollution Control
EMISSIONS (SOURCE) TESTING IN METROPOLITAN TORONTO. APPENDIX 309. 29p., June 3, 1963. 24 refs.

Laws and regulations relating to the design, operation, and emission limits of a chimney or stack are summarized. The historical development of sampling equipment and techniques is traced. The instruments presently used for sampling were tested in a wind tunnel of varying diameter and temperature. The isokinetic sampling method should be used for the proper accuracy of results, especially with nozzles less than one inch in diameter. Instructions are given on preparations to be made before emission tests, preliminary testing, stack velocity testing, temperature testing, and calculation of gas velocity. A description is given of equipment available in the Toronto area, which includes sampling probes, filtering or collecting devices for particulate matter, condensers, metering devices, and suction units. A procedure is summarized in 10 steps for operating samplers at fixed points. Suggestions are given on starting time, number and duration of runs, and frequency of readings.

2040 APTIC NUMBER 20250

Nader, John S.
INSTRUMENTATION IN THE STUDY OF AIR POLLUTION. Preprint, Instrument Society of America, Pittsburgh, Pa., 22p., 1962. 3 refs. (Presented at the Symposium of the Instrument Society of America, Analysis Instrumentation, 8th National, Charleston, W. Va., April 30, 1962.)

A brief summary is given of procedures and instrumentation in the measurement of air quality, with emphasis on direct-reading analyzers. Criteria for the design and performance of instruments are simplicity, stability, reliability, minimum zero drift, reproducibility, accuracy, sensitivity, specificity, and response time. Much work needs to be done in the area of accumulating and handling data. Large quantities of data call for direct-reading instruments and more fully automated processing while maintaining compactness, low cost, and reliability. Direct dosimetric measurement needs to be explored as a means of measuring exposure dosage, of importance in determining the effects of pollution (corrosion, toxicity, visibility, etc.). It involves the measurement of the time interval necessary to accumulate a predetermined level of total exposure, mathematically equivalent to the integral of concentration and time. Listings are given of 32 direct-reading analyzers for gas contaminants and 22 analyzers for particulates, together with a list of 27 manufacturers from whom most of these instruments are available.

2041 APTIC NUMBER 17987

O'Keeffe, Andrew E.
MODERN METHODS FOR MONITORING ATMOSPHERIC SULFUR DIOXIDE. Preprint, Purdue Univ., Lafayette, Ind., 14p., 1969. (Presented at the Indiana Air Pollution Control Conference, 8th, Lafayette, Oct. 14, 1969.)

The lead candle method, conductometric measurement of atmospheric sulfur dioxide, colorimetry, and coulometry are reviewed. The lead candle provides no integral means for obtaining a readout of the concentration. However, it has provided valuable information in assessing the magnitude of the air pollution problem. Conductometric instruments suffer from interference caused by the presence of any ionic species. Colorimetry suffers from the use of aqueous solutions. Response time is slow. Coulometric instruments suffer the effects of loss of water by evaporation or inactivation by freezing. Over the past two years, a new SO2 monitor appeared, the flame photometric detector. A sample of air is burned in a hydrogen-rich flame, all volatile sulfur is converted to diatomic sulfur and excited. Upon reaching a region above the flame, it is returned to ground-state S2. This transition is accompanied by a release of light energy. A photomultiplier and a recorder are attached. The instrument records total volatile sulfur which is almost always synonymous with SO2. An instrument has been developed which provides absolutley specific measurements of individual sulfur-containing compounds. Using the flame photometric device as a gas chromatographic detector, an air sample is anlayzed and the findings are reported every 5 min, with a sensitivity of 1 ppb H2S. The electrochemical transducer is another device that offers considerable promise. A galvanic cell operates by means of electrochemical oxidation of SO2 to sulfate ion. Research is in progress to evaluate the potential of plasma spectroscopy for SO2 monitoring.

2042 APTIC NUMBER 20202

Okita, T.
FILTER METHOD FOR THE DETERMINATION OF TRACE QUANTITIES OF AMINES, MERCAPTANS, AND ORGANIC SULPHIDES IN THE ATMOSPHERE. Atmos. Environ. Vol. 4:93-102, 1970. 9 refs.

Low-molecular weight mercaptans, dimethyl sulfide, and methylamine are the dominant malodorous pollutants in Japanese urban and industrial areas. For measuring environmental concentrations of these gases, glass fiber filters were first stored in a silica gel dessicator and then impregnated with mercuric salts and sulfuric acid. Air was drawn through the filters at 100 l reciprocal min by a commercial air-cleaner blower. Sampling time ranged from 10 to 30 min. After collection, the gases were recovered from the filters, concentrated, and analyzed by a gas chromatograph with a flame ionization detector. This method enables gases to be determined in concentrations of 1 ppb or less, although olefins collected by the mercuric salts are a source of interference. Electron capture or electroconductivity detectors would eliminate such interference. Measured concentrations of the gases at five sampling stations are tabulated, and chromatograms are shown of the gases sampled at a primary school, pulp mill, and fish meal plant.

2043 APTIC NUMBER 20025

Payne, William W.
METHODS OF SAMPLING, SEPARATION, AND ANALYSIS OF AIR POLLUTANTS: SPECIAL REQUIREMENTS FOR CARCINOGENIC BIOASSAY. Nat. Cancer Inst. Monograph, no. 9:75-80, 1962. 11 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollutants, Cincinnatic, Ohio, Aug. 29-31, 1961.)

The history of biological testing of air polluntants is traced from 1922 to 1961, and previous work is critically analyzed. The weaknesses of such work are indicated. Only a portion of pollutants in the air are collected. Usually only the organic fraction, or even a part of this, is recovered from particulate matter. Gas and other constituents not soluble in the extraction agent are ignored. The effect of collection and processing methods is not fully known. Carcinogens in samples kept for any length of time may oxidize or be otherwise altered through non-carcinogenic compounds. Insufficient attention is given to the interaction between atmospheric constituents which could either reduce or potentiate the cancer-causing properties of various constituents. More intensive studies of smaller geographical areas are strongly recommended. Substances containing air-pollutant material should be collected and recovered as much as possible without the use of a vehicle and administered directly to the test animals. Care should be taken to provide a sufficient number of sampling stations and to take into consideration the meterology, topography, and pollution sources in the area studied. Sufficent material should be be provided to permit administration to a large number of animals for a long period, to more than one species of animal, and by more than one mode of administration.

2044 APTIC NUMBER 20840

Quenzel, H.
DETERMINATION OF SIZE DISTRIBUTION OF ATMOSPHERIC AEROSOL PARTICLES FROM SPECIAL SOLAR RADIATION MEASUREMENTS. J. Geophys. Res., 75(15):2915-2921, May 20, 1970. 3 refs.

The extinction coefficient in a vertical column was determined from spectral solar radiation measurements. The intensity of direct solar radiation at ground level was measured in eight spectral channels between 0.4 micron and 1.6 micron, each equipped with a narrow interference filter all filters were located in atmospheric windows between absorption bands of atmospheric gases. The alternation of solar radiation in the observed spectral regions was thus caused by scattering by air molecules and aerosol particles, but not by band - absorption of atmospheric gases. The amount of diminertion is commonly described by the extinction coefficient, which is defined by the Bouguer - Lambert Law. The optical thickness of molecule scattering is known from Rayleigh theory. The corresponding aerosol size distributions were derived by comparison with Mie calculations. Ground-level measurements over the tropical Atlantic Ocean show that a distribution having a maximum particle concentration near 0.4 micron radius is superimposed on the usual power-law distrubution. This distribution can be described by a logarithmic Gaussian (log-normal) distribution. (Author abstract)

2045 APTIC NUMBER 20081

Sawicki, E., R. C. Corey, A. E. Dooley, J. B. Gisclard, J. L. Monkman, R. E. Neligan, and L. A. Ripperton
TENTATIVE METHOD OF ANALYSIS FOR POLYNUCLEAR AROMATIC HYDROCARBON CONTENT OF ATMOSPHERIC PARTICULATE MATTER. Health Lab. Sci. Suppl., 7(1):31-59, Jan. 1970. 12 refs.

A high-volume air sampler is used to collect air particulate samples for analysis of their polynuclear aromatic hydrocarbon content. The samples are extracted with benzene to obtain a benzene-soluble fraction of air particulate matter. This organic fraction is further separated into approximately 30-40 sub-fractions by column chromatography, using increasing amounts of diethyl ether in pentane as the eluent. Each sub-fraction is dried, dissolved in pentane, and then analyzed spectrophotometrically. Polynuclear aromatic hydrocarbons that are effectively separated and analyzed by this method are anthracene, phenanthrene, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(a)pyrene, benzo(e)pyrene, peryiene, benzo(g,h,i)perylene, anthanthrene, and coronene. Microgram quantities of the various hydrocarbons per 1000 cu m of air are easily determined by the method. The exact sensitivity of the method depends on volume of air sampled, the amount of particulate matter present, and the corresponding amount of organic fraction obtained. Results for samples taken in the same vicinity at the same time should show a sensitivity of plus or minus 15-20%.

2046 APTIC NUMBER 20203

Sawicki, E., R. C. Corey, A. E. Dooley, J. B. Gisclard, J. L. Monkman, R. E. Neligan, and L. A. Ripperton

TENTATIVE METHOD OF ROUTINE ANALYSIS FOR POLYNUCLEAR AROMATIC HYDROCARBON CONTENT OF ATMOSPHERIC PARTICULATE MATTER. Health Lab Sci. Suppl., 7(1):45-54, Jan. 1970. 15 refs.

Samples of the polycyclic hydrocarbons in the atmosphere are collected by 'high-vol' filtration through glass fiber filters. The particulate material is separated by column chromatography into 40-60 fractions which are subjected to spectrophotometric and fluorimetric analysis. Separation and estimation of about 6-12 polycyclic hydrocarbons can be carried out by this procedure. Microgram quantities of the various hydrocarbons/1000 cu m of air can be determined, depending upon the volume of air sampled, the amount of particulate matter present, and the corresponding amount of organic fraction obtained. Since the identification and estimation of the individual polycyclics is carried out by comparison of the unknown spectra with spectra of known pure compounds, every effort must be made to eliminate interfering compounds and maintain the systems free of background contamination which would modify the wavelength of the bands. The greatest accuracy will be obtained from measurements made on spectra which resemble as closely as possible the standard curves for the pure substances. The wavelength scale of the ultraviolet instrument usually used in this work should be accurate to 0.2 nm. The wavelength scale of the fluorimeter should also be accurate to 0.2 nm with the instrumental reproducibility equal to 0.1 or 0.2 nm. The complete analysis of a prepared air sample extract, including chromatographic measurements by ultraviolet or fluorescence and calculations, requires two days.

2047 APTIC NUMBER 20204

Sawicki, E., H. C. Corey, A. E. Dooley, J. B. Gisclard, J. L. Monkman, R. E. Neligan, and L. A. Ripperton
TENTATIVE METHOD OF CHROMATOGRAPHIC ANALYSIS FOR BENZO(A)PYRENE AND BENZO(K)FLUORANTHENE IN ATMOSPHERIC PARTICULATE MATTER. Health Lab Sci. Suppl., 7(1):60-67, Jan. 1970. 2 refs.

A rapid method for the measurement of benzo(a)pyrene (BaP) and benzo (k) fluoranthene (BkF) in air samples is described, based on the chromatographic separation of air sample extracts on an activated alumina column using a polar solvent, toluene, as the eluting agent. The concentration of hydrocarbon in the eluates is determined from fluorescence emission measurements made on the eluates. The method can measure concentrations in a prepared air sample extract or fraction over the range of 0-0.25 micrograms of BaP or BkF/ml of solution. Interferences involve primarily an ability to measure one of the hydrocarbons in question in the presence of the other. With this procedure, 0.25 micrograms of BaP/1 ml can be measured with an accuracy of better than 0.002 micrograms, while 0.25 micrograms of BkF can be measured with an accuracy of better than 0.001 micrograms. If the concentration of BaP found is more than twice the BkF concentration, the BkF results will be in error by a factor of 10%. In such a case, suitable mathematical corrections can be made. The apparatus, reagents, procedure, calibration, standards, calculations, and effects of storage are reviewed.

2048 APTIC NUMBER 18178

Schultz, Frederick C.
METHOD AND APPARATUS FOR THE DIRECT DETERMINATION OF GASES. (Laboratory Equipment Corp., St. Joseph, Mich.), U. S. Pat. 3,427,863, 6p., Feb. 18, 1969. 7 refs. (Appl. Nov. 21, 1966, 2 claims).

An analytical procedure is claimed for measuring gases and gas-forming elements in solid samples. It is particularly designed for use in measuring oxygen, nitrogen, carbon, or sulfur in steel samples. The procedure involves placing the sample in a chamber which can be heated to a temperature necessary to remove all the element of interest. Through this chamber is passed a carrier gas which can either carry off the liberated gas or, as in the case of carbon or sulfur, react with the element of interest to form a volatile compound. In this case the carrier gas would be oxygen. A cold trap placed down stream from the oven will condense all the volatile material until the end of the volatilization period after which a second stream of inert carrier gas would be passed through the trap to revolatilize the gases and pass them through a chromatographic column to separate the various gases, after which they are passed through a thermal conductivity cell for measurement. The advantage of the system is the total measurement of the element of interest in the sample; this method obviates the inherent errors in a partitioning system. A novel transfer stopcock is included in the design which alters all the gas flows in one motion. A leakproof sample loading system is also employed to permit the loading of large samples with a minimum of contaminating air.

2049 APTIC NUMBER 20117

Shaffernocker, Wayne M. and Charles M. Stanforth
SMOKE MEASUREMENT TECHNIQUES. SAE (Soc. Automotive Engrs.) Trans., 77(2):1059-1079, 1969. 21 refs. (Paper 680346.)

Techniques for the measurement of the smoking characteristics of jet engines and jet engine components, including optical systems, a quantitative gravimetric system, and soiled tape methods, are evaluated; a calculation procedure is described for making a direct comparison of any two soiled tape methods. The soiled tape method utilizes a GE spot meter which filters the smoke through Whatman paper and produces a smoke number that is based on the diffuse reflection from the filtrate produced by filtering 0.3 cu ft of smoke through a square inch of filter paper. A composite curve is made by plotting each system referred to in this paper against the proposed smoke number. The optical meters, Bosch and Von Brand (0.108) systems, are insensitive to light smoke and sensitive to heavy smoke, while the Bacharach stained filter paper system is sensitive to light smoke. (Author abstract modified)

2050 APTIC NUMBER 20865

Shleien, B., R. G. Heatherton, P. F. Hildebrant, L. B. Lockhart, Jr., R. S. Morse, W. Stein, and D. F. Van Farowe
TENTATIVE METHOD OF ANALYSIS FOR IODINE-131 CONTENT OF THE ATMOSPHERE (PARTICULATE FILTER-CHARCOAL GAMMA). Health Lab. Sci. Suppl., 7(1):108-111, Jan. 1970. 3 refs.

Radioactive iodine presents a unique sampling problem, since it may be introduced into the atmosphere as an elemental or chemically combined vapor, as a vapor adsorbed on particulate matter, or as a particulate iodine compound. The proposed method involves sampling iodine in its solid and gaseous states with an 'absolute' particulate filter in series with an activated charcoal cartridge. The I(131) activity is then quantitatively determined by gamma spectroscopy. Iodine adsorbed on solid particles and possibily some vaporous iodine will be deposited on the filter while the remaining vaporous iodine will be adsorbed on the activated charcoal. Samples may be collected continuously for a week or more at low flow rates or for 24 hr or less at a high flow rate.

2051 APTIC NUMBER 17843

Siburu, J. R., R. L. Catalina, and A. Singerman
SPECTROFLUORIMETRIC DETERMINATION OF 3,4-BENZOPYRENE. (Determinacion espectrofluorimetrica de 3-4 benzopireno). Text in Spanish. Rev. Assoc. Bioquim. Arg., 31(167):190-194, 1966. 10 refs.

A technique for isolating and quantitatively determining 3,4-benzopyrene by a combination of thin-layer chromatography and spectrofluorimetry is proposed as part of a project for the quantitative determination of polycyclic aromatic hydrocarbons in the atmosphere of Buenos Aires, Argentina. Chromatography is conducted over silica gel to which caffeine has been added, according to the technique of Berg and Lam. Before elution of the hydrocarbon with benzene, spectrofluorimetric determinations are made with a recording spectrophotometer with a fluorescence attachment. Quantitative curves are drawn on the basis of the fluorescence emission spectra. The lower limit of sensitivity was established at 0.05 micrograms. At this concentration, the 3,4-benzopyrene produced a spot that was clearly visible under ultraviolet light on the chromatographic plate. For concentrations of the hydrogen on the order of tenths of a microgram per milliliter, the emission spectrum consisted of three peaks of descending height. For higher concentrations, the spectra varied. For quantitative determinations, the concentration of benzopyrene was considered proportional to the difference between the 405.6 millimicron peak of emission nd the next minimum point (420 millimicrons).

2052 APTIC NUMBER 20864

Smith, R. G., R. J. Bryan, M. Feldstein, B. Levadie, F. A. Miller, E. R. Stephens, and N. G. White.
TENTATIVE METHOD OF ANALYSIS FOR FORMALDEHYDE CONTENT OF THE ATMOSPHERE (COLOMETRIC METHOD). Health Lab. Sci. Suppl. 7(1):87-91, Jan. 1970. 8 refs.

A method of analyzing air samples for formaldehyde is based on reacting formaldehyde with a chromotropic acid-sulfuric acid solution to obtain a purple monocationic chromogen. The absorbance of the solution is read in a spectrophotometer at 580 nm and is proportional to the quantity of formaldehyde in the solution. The formaldehyde content of the sampling solution is determined from a curve previously prepared from standard formaldehyde solutions. From 0.1 microgram/ml to 2.0 micrograms/ml of formaldehyde can be measured in the color developed solution (10.1 ml). An equation is presented for calculating the concentration of formaldehyde in the sampled atmosphere.

2053 APTIC NUMBER 20208

Snyder, Arthur D. and George W. Wooten
FEASIBILITY STUDY FOR THE DEVELOPMENT OF A MULTIFUNCTIONAL EMISSION DETECTOR FOR NO, CO, AND SO2. (FYNAL REPORT). Monsanto Research Corp., Dayton, Ohio, NAPCA Contract CPA 22-69-8, 57p., Oct. 19, 1969. 30 refs.
CFSTI: PB 188103

The feasibility of multifunctional detection of nitric oxide, carbon monoxide, and sulfur dioxide in ambient air, based on the chemiluminescent reaction of these pollutants with atomic oxygen, was studied in a laboratory prototype detection system. Atomic oxygen was produced by a mircowave discharge through molecular oxygen. A constant atom concentration in large excess over the concentration of the pollutant(s) was maintained. Under these conditions the intensity of the chemiluminescent glow should increase monotonically with increasing pollutant concentration. The detective system consisted of a vacuum system, a reaction chamber, a mircowave generator with associated powermeter and quarterwave cavity, and a dual detection system consisting of a 1.5-meter spectrograph or an optical filter-photomultiplier, amplifier, and recorder combination. A metering and mixing system delivered known pollutant concentrations in the low ppb range to the reaction chamber. Concentrations as low as 5 ppb NO have been detected, and laboratory evidence predicts detection capabilities for SO2 to be below 1 ppb. The CO-O reaction produced insufficient glow for adequate detection below approximately 100 ppm. A linear relationship was established between glow intensity and pollutant concentration in all cases. Nitrogen dioxide interfered with NO detection but no other serious interference problem was observed. The responses of NO2 and NO were indentical, but the method still provides a sensitive means for detecting NO-NO2 in ppb concentrations. (Author abstract modified)

2054 APTIC NUMBER 18194

Sullivan, D. C., D. F. Adams, and F. A. Young
DESIGN OF AN "ODOR PERCEPTION AND OBJECTIONABILITY THRESHOLD" TEST FACILITY. Atmos. Environ., 2(2):121-133, March 1968. 25 refs.

The design requirements for the study of the thresholds of odor perception and objectionability within a large population of human subjects are discussed. The collection of an adequate body of data was facilitated by the conversion of a 35 ft. bus into an air conditioned, mobile odor perception laboratory containing six identical face exposure chambers, each providing a different, known, controlled (and readily changeable) odor concentration. The mobility of the laboratory permits the evaluation of the responses of diverse groups of test subjects at fairs, expositions, elementary schools and universities. A dynamic system of odor generation is used which provides a range of concentrations within the exposure chambers from ppm to at least 1 ppb. Subjects

consecutively sample the test atmospheres from the six chambers, each containing a different concentration of the same compound. Ascending, descending and random presentation of concentrations have been employed. Concentrations range from undetectable to detectable by most subjects. The test subjects report, for each chamber, whether or not an odor is detected and whether their response to the odor was pleasant or unpleasant. In addition, each subject provides comprehensive information concerning many variables including age, sex, smoking habits, respiratory abnormalities, and occupation. These data are transferred to punched cards and analyzed for possible significant influence upon the response to odor levels. (Author Abstract)

2055 APTIC NUMBER 20192

Trieff, Norman M., William Colver, Stephen Field, Karl L. Gabriel, and Anil K. Mukherji
ISOLATION OF ODOROUS COMPONENTS PRESENT IN RENDERING PLANT EMISSIONS. Preprint, Drexel Inst. of Technology, Philadelphia, Pa., Environmental Engineering and Science Program and Drexel Inst. of Technology, Philadelphia, Pa., Dept. of Chemistry, 11p., 1968 (?). 4 refs.

Attempts were made to isolate odorous components responsible for the odor of rendering plant emissions. Three techniques were used: adsorption of odors on charcoal followed by solvent extraction; solvent extraction of rendering plant products; and extraction of solid from a Hi-volume filter. In each case analysis was done by the infrared spectra. The first technique gave negative results; the second and third methods detected the presence of a n-butylhexanoate or a congener. The musky odor of the extract was different from the mixed odor of the extract was different from the mixed odor of the commercial product suggesting the presence in the extract of other components in amounts too small to be detected. One of the components could be hexanoic acid, which presumably has a low threshold dilution level and, therefore, could be detected organoleptically at a level much lower than that required for infrared analysis. The component could also be the congener n-ethylhexanoate, which has virtually the same infrared spectrum as hexanoic acid. It is concluded that the musky type of odorous emission from rendering plants is a highly complex emission containing a number of odorous components.

2056 APTIC NUMBER 20190

Tuesday, C. S., B. A. D'Alleva, J. M. Heuss, and G. J. Nebel
THE GENERAL MOTORS SMOG CHAMBER. Air Pollution Control Association, New York City, 59p., 1965. 21 refs. (Presented at the Air Pollution Control Association Annual Meeting 58th, Toronto, Canada, June 20-24, 1965, Paper 65-19)

The General Motors smog chamber facility was constructed to study the influence of various vehicle parameters on smog formation as well as the chemistry of smog formation. The facility includes a dynamometer arrangement, controls for automatically driving a vehicle through pre-determined driving cycles, and a system that samples a constant proportion of the vehicle exhaust gas flow and dilutes this sample with known amounts of purified air. In the chamber itself, the diluted sample is irradiated under atmospheric conditions. A number of analytical instruments are used, together with eye irritation exposures, to measure aspects of smog formation. The effects of hydrocarbons and nitrogen oxides in concentrations found in polluted atmospheres on smog formation were recently investigated. Initial concentrations of the pollutants were varied by changes in vehicle carburetion, changes in the exhaust gas dilution ratio, and the addition of various amounts of nitric oxide. Results of the investigation indicate that decreased concentrations of hydrocarbon decrease ozone formation, formaldehyde formation, and eye irritation. Decreased concentrations of nitrogen oxides have no effect on eye irritation or formaldehyde formation, but markedly increase ozone formation. (Author abstract modified)

2057 APTIC NUMBER 20201

Weber, David C. and Edward J. Spanier
AN AUTOMATIC GAS SAMPLING DEVICE. Anal. Chem., 42(4):546-548, April 1970. 2 refs.

A simple and inexpensive sequential sampler was developed for sampling a gas stream at fixed intervals over extended periods of time. The principle portion of the apparatus is a 12-in. copper pipe that serves as the gas manifold. A Teflon piston travels through the manifold and directs the gas stream through the successive exhaust ports of the manifold. The piston is operated by a saw-tooth ratchet supported by a track. The driving solenoid of the system is connected to a lever attached to the track. The system is energized by a commercial electric timer. The latter contains an adjustable clock, an electric clutch to engage the clock, and a normally open internal relay that is closed at the end of the timing cycle. The timer clutch is operated through an external relay. Gas flows at 10-20 cc/min from a reaction vessel through a mercury trap, through the manifold and piston to exit through the exhaust ports and then be expelled in water.

2058 APTIC NUMBER 20030

Wyszynska, Halina, Konrad Kosinski, Stefan Maziarka, Zbigniew Misiakiewicz, and Artur Strusinski
METHODS OF STUDY OF ATMOSPHERIC AIR FROM THE HYGIENIC POINT OF VIEW. (Metody sanitarnego badania powietrza atmosferycznego). Text in Polish. Wydawnictwa Metodyczne Panstwowego Zakladu Higieny (Methodologic Study Govt. Dept. Hyg.). no. 10, 141p., 1968. 82 refs.

Methods of determining pollutants, the admissible concentration of which was limited by Polish legislation, and determining a number of other atmospheric pollutants which in excessive amounts are either hazardous to health or cause damage by corrosion are reviewed. Determination of air dustiness, chemical analysis of dust, and determination of sulfur dioxide, sulfur trioxide, carbon disulfide, nitrogen dioxide, nitric oxide, fluorine, chlorine, hydrogen chloride, ozone, phenol, benzene, chlorbenzene, and aniline are presented. A description of each method includes principles of the method, its limitations, a description of the apparatus procedure of sample collection, and data evaluation.

The apparatus required usually are not expensive and complicated, but they have to be precise and well calibrated because of the extremely low concentrations measured. The reagents used have to be of high purity. Most of the methods described were verified and tested on the laboratory scale and in routine determination of pollution. Thus no difficulty should be encountered in their application.

# AIR QUALITY MEASUREMENTS

2059 APTIC NUMBER 20191

Cross, Frank L. Jr., Ronald J. Drago, and Harold E. Francis
METALS IN EMISSIONS FROM INCINERATORS BURNING SEWAGE SLUDGE AND MIXED REFUSE. Preprint, National Air Pollution Control Administration, Research Triangle Park, N.C., Office of Manpower Development and Connecticut State Dept. of Health, Hartford, 15p., 1969. 3 refs.

The metals and particulates content in the atmospheric emissions from a 300-ton-per-day incinerator burning mixed refuse and sewage sludge were investigated. Three isokinetic samples were collected while the system was burning refuse and three while burning mixed refuse and dried sludge. The emissions from burning refuse plus sludge were 1.7 times greater than burning refuse alone. The emissions of metals while burning refuse ranged from 0.007 lbs/hr (Cd) to 1.5 lbs/hr (Pb), and when burning refuse and sludge from 0.007 lbs/hr (Cd) to 2.13 lbs/hr (Zn). The incinerator charging rate was determined during the tests, and emission factors were calculated in terms of pounds of metals discharged from the stack per ton of fuel charged to the incinerator. Emission factors ranged from 0.00077 to 0.15 lbs/ton while burning mixed refuse and from 0.00057 to 0.18 lbs/ton while burning refuse and sludge. The ratio of refuse to sludge in the charges during these tests was approximately 3.5 to 1. The burning rate during these tests averaged 85% of the rated capacity of the incinerator. The removal and recovery of metals from incinerator stack gases is a problem for the design engineer; the effect of the airborne metals on the environment a problem for the ecologist.

2060 APTIC NUMBER 20094

Fukuoka, Saburo
RELATION BETWEEN THE CONCENTRATION OF SULFUROUS GAS AND THE WEATHER CONDITION AT VARIOUS ALTITUDES AT THE TOWER OF TOKYO IN SPRING. (Tokyo tawa no shunki niokeru kodobetsu aryusanismgasunodo to kishojoken tono kankei). Text in Japanese. Taiki Osen Nyusu (Air Pollution News), no. 54:2-5, Sept. 1969.

Continuous monitoring of sulfur dioxide concentration has been in operation since Feb. 1969; the data, together with the recordings from previously installed meteorological devices at various altitudes of Tokyo Tower, yield information on the three-dimensional structure of air pollution in Tokyo. The analysis for spring, 1969 was based on the data from the tower. The graphical representation of the data on wind direction and velocity indicate that wind speed reaches a maximum at 1600 hrs at all three levels, although wind direction varies individually. Histograms on the stability of the atmosphere show the various times of day at which inversions occur at different levels. Data on the average concentration and frequency of sulfur dioxide and the variation in its concentrations throughout the day demonstrate that it increases with altitude, reaching the monthly average of about 0.1 ppm at 125 m between March and May, 1969. The same is true for the frequency of high concentrations, with 0.4 ppm or more recorded at 225 m and 0.2 to 0.3 ppm at 125 m. When a two-day smog warning was issued, the concentration at 225 m was over 0.5 ppm. The daily variations of sulfur-dioxide concentration indicate that there is an extreme difference between night and day, with lags in peaking appearing at different altitudes. The rose window plots of average concentration for different wind directions demonstrate that at 125 m and 225 m, high concentrations are transported by SSW as well as S and W winds. The southerly wind has little effect on concentration, but the northerly wind reduces concentration with an increase in velocity. The effects at lower altitudes are much smaller. Thus the conclusion can be drawn that high concentrations of sulfur dioxide originate from S to SSW, and the effect of height of the emission sources are apparently large enough to allow the flow of high-concentration sulfur dioxide at 100 to 250 m over the central and southwestern area of Tokyo. The present study focused attention on springtime, but the year-round data is expected to allow future studies for the entire year.

2061 APTIC NUMBER 20160

Green, Christine R. and Louis J. Battan
A STUDY OF VISIBILITY VERSUS POPULATION GROWTH IN ARIZONA. J. Ariz. Acad. Sci., vol. 4:226-228, Oct. 1967. 1 ref.

Visibility statistics based on observations by the U. S. Weather Bureau at the Tucson and Phoenix, Arizona, airports at 1100 and 1700 MST daily are compared with population estimates for the years 1939-1965. Visibility statistics were based on the number of occasions per year when visibility was equal to or less than 15 and 30 miles. An abrupt improvement in Phoenix visibility between 1957 and 1958 is thought to result from revisions in the procedures for observing visibility. Prior to mid-1958, visibility was estimated in the northwest direction from Phoenix airport, or directly across the atmosphere of the Phoenix business district, whereas after mid-1958, the indicators were located in other directions from the airport, where it is assumed that there would be less air pollution. At Tucson, where there were no known procedural changes in observation during the 17-year period, the figures show an increase in the frequency of days with 'poor' visibility. The frequency of the occasions of low visibility were 6-10 times higher in Phoenix than in Tucson. The cities are 125 miles apart and in similar climatological regions, but the Phoenix area is more heavily populated and more highly industrialized.

2062 APTIC NUMBER 20051

Japan Productivity Center, Pollution Control and Abatement Study Team to Europe
OUTLINE OF PUBLIC NUISANCE PROBLEMS IN JAPAN (PRESENT SITUATION AND MEASURES). 18p., March 1969.

Changes in air pollution (sulfur dioxide, soot, and dust, carbon monoxide, nitric oxide, and nitrogen dioxide) in major Japanese cities during the past decade are reported. Data are also given for water, noise, and malodorous pollution. Legislative measures taken to combat these nuisances are reviewed. Other subjects touched on are as follows: preliminary survey of public nuisances; technical development and research; various promotional measures; surveillance and measurement of public

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nuisances; establishment of environmental standards; formulation of plans for prevention of public nuisances; promotion of technical measures; and settlement of disputes and rescue of sufferers.

2063 APTIC NUMBER 20847

Lazrus, A. L., H. W. Baynton, and J. P. Lodge, Jr.
TRACE CONSTITUENTS IN OCEANIC CLOUD WATER AND THEIR ORIGIN.
Tellus (Uppsala), 22(1):106-114, 1970. 25 refs.

Samples of oceanic cloud water collected during periods of varying rates of sea salt aerosol production were analyzed for chloride, sodium, magnesium, calcium, and sulfate ions. For each of the ions, the portions originating from sea salt, chemical fractionation, and advected materials were calculated. Enrichment by chemical fractionation of sea salt was detected only in the case of magnesium. Considerable contributions of calcium and sulfate from origins, other than sea salt were observed. Evidence indicates that excess chloride occurs erratically, and originates from volcanic activity. (Author abstract)

2064 APTIC NUMBER 20022

Lindsey, A. J.
SOME OBSERVATIONS ON THE RELATIVE QUANTITIES OF AIR POLLUTANTS IN VARIOUS LOCATIONS. Nat. Cancer Inst. Monograph, no. 9:235-250, 1962. 63 refs.

Extensive study has been made of some constituents of the atmosphere, while other pollutants and groups of pollutants have been relatively neglected. Whereas attention has been focused on organic pollutants, in England at least the major constituents of total air solids are inorganic in nature. Amounts and proportions vary according to season, climate, and time of day, while the industrial picture changes constantly due to the imposition of legal restraints and the use of new materials. The state of knowlege as of 1961 regarding the total air solids composition of the atmosphere is summarized, with special attention to polycyclic aromatic hydrocarbons, arsenic, iron, germanium, lead, and vanadium. A list is given of 22 elements detected in ash captured from an urban atmosphere, and a 63-reference bibliography is given of works on combustion chemistry, tobacco-smoke, and atmospheric pollution.

2065 APTIC NUMBER 20855

Ludwig, John H., George B. Morgan, and Thomas B. McMullen
TRENDS IN URBAN AIR QUALITY. Trans. Am. Geophys. Union, 51(5):468-475, May 1970. 9 refs. (Presented at the National Fall Meeting of the American Geophysical Union, San Francisco, Calif., Dec. 17, 1969.)

Samples of total suspended particulates collected at various urban and nonurban areas have been analyzed for certain metal and nonmetal substances that inhibit biological activity. Iron, lead and zinc were found to be the most abundant metals in the atmosphere. For all but copper urban fractions are typically twice those found at nonurban locations. Lead, vanadium, and nickel showed increased levels in larger cities, indicating that the size of the urban area is a determining factor in the atmospheric levels of some metals. There has been a decrease in settling particulates in major urban areas, reflecting the application of control techniques and the change in domestic fuel from coal to oil and gas. Sulfur dioxide levels may be decreasing in many large cities, perhaps due to the limits on allowable sulfur in coal together with renewal which replaces buildings that had used heavy fuels for heating. Very little can be said about the changes in levels of carbon monoxide and oxidants. This lack of sufficient data from which to establish trends in air quality reflects the only recent attention of our society to the impact of air pollution on our environment, as well as the costs associated with collecting data of quality and quantity sufficient to assess trends.

2066 APTIC NUMBER 20868

Mrose, H. and W. Warmbt
SO2 MEASUREMENTS AT THE PERIPHERY OF A LARGE TOWN; COMPARING LOW AND HIGH ALTITUDES. (SO2-Registrierungen am Rande einer Grossstadt-Vergleich zwischen Tal- und Hoehenlage). Text in German. Z. Meteorol., 21(5-7):182-190, Dec. 1969. 4 refs.

Measurements of sulfur dioxide were made from January to April 1968 at two points, 1.4 km apart, on the periphery of Dresden. One of the points was in a valley 120 m above msl; the other, on an elevated plain 246 m above msl. Only slight differences were observed in average sulfur dioxide concentrations, frequency distributions, and diurnal variations at the two sampling sites. The differences occur only when the exchange and the circulation between the valley and the plain are different, e.g., with high-pressure situations, inversions, and frontal passages. The peculiarities in concentrations are illustrated by individual cases.

2067 APTIC NUMBER 20834

Ordman, David
SEASONAL RESPIRATORY ALLERGY IN WINDHOEK: THE POLLEN AND FUNGUS FACTORS. S. African Med. J. Johnannesburg, 44(9):250-253, Feb. 28, 1970. 3 refs.

An aerobiological survey of Windhoek in South West Africa was carried out for a period of two years (1967-1968). Findings regarding pollen grains and fungus spores in the atmosphere were revealed. Thirteen different pollens were identified. The most predominant was that of the grasses. To a relatively lesser extent, but still of importance were the pollens of cypress and Prosopis. The grass pollen season commences in December-January, peaks in March-April, and effectively terminates in May. The cypress pollen incidence peaks in August-September and Prosopis pollen incidence peaks in October. None of the 18 varieties of the fungi identified showed any significant seasonal peaking. Only four of the fungi identified appeared in concentrations worthy of mention: Cladosporium, Smuts, Alternaria, and Ascospores. The relationship between the various pollens and

seasonal respiratory allergy reactions is presented. Particular mention is made of Prosopis pollen. A patient with hayfever symptoms in the month of October can almost invariably be regarded as suffering from Prosopis pollinosis.

2068 APTIC NUMBER 20077

Procel, Emilio Garcia and Mario Salazar Mallen
AIR POLLUTION IN MEXICO CITY. (La contaminacion atmosferica en la ciudad de Mexico). Text in Spanish. Alergia (Mexico), 17(3):89-97, 1970.

A semiquantitative analysis was made of atmospheric carbon monoxide, sulfur dioxide, and nitrogen dioxide in Mexico City, using a vacuum pump. Samples were taken in a heavily traveled residential zone, a quiet residential zone, an industrial zone, and a congested downtown area, on Wednesdays and Sundays from May 1957 to May 1968. Correlation with meteorological conditions showed that the air of Mexico City contains relatively high levels of CO, although within accepted limits, and smaller quantities of SO2 and NO2; pollution decreases on Sundays and increases during the week, due to an increase in vehicular traffic and human activity; in springtime, the pollution decreases due to a greater movement of air masses, while on cold and cloudy days it increases; and there is a strong correlation between vehicular traffic and the amount of pollution. Carbon monoxide readings of 100 ppm were recorded in 2 areas of the city during the hours of heavy traffic (November 22 and 29, December 13, and February 18 and 25). A median recording of 70 ppm was made during the warmer months at these same locations.

2069 APTIC NUMBER 20849

Rangarajan, C. and Smt. S. Gopalakrishnan
SEASONAL VARIATION OF BERYLLIUM -7 RELATIVE TO CAESIUM -137 IN SURFACE AIR AT TROPICAL AND SUBTROPICAL LATITUDES. Tellus (Uppsala), 22(1):115-121, 1970. 16 refs.

A comparative study of the seasonal variations of cosmic-ray produced Beryllium -7 (Be -7) and fission product Caesium-137 (Cs-137) was conducted in the surface air at Bombay and elsewhere. Both isotopes attain peak values during the spring months. The amplitude of increase is much less in the case of Be-7 compared to stratospheric Cs-137. This difference is due to only a part of Be-7 in surface air being of stratospheric origin. By comparison with Cs-137, it is estimated that the stratospheric component of Be-7 is about 60% in spring, decreasing to 25% in the autumn. Both isotopes are controlled by the same meteorological processes which evidently transfer them from the upper tropsphere to ground level.

2070 APTIC NUMBER 20059

Seiler, W. and C. Junge
CARBON MONOXIDE IN THE ATMOSPHERE. J. Geophys. Res., 75(12):2217-2226, April 20, 1970. 15 refs.

A study of the global distribution of carbon monoxide in the atmosphere demonstrates the following: the upper troposphere of the northern hemisphere has a CO mixing ratio range of 0.10-0.15 ppm; CO concentrations are 0.16-0.30 ppm in the planetary boundary layer above the north Atlantic and in high index situations over western Europe; no marked difference is noted between northern and southern hemispheres in mid-tropospheric data; and the surface waters of the Atlantic Ocean at 30 deg W between the latitudes of 10 deg S and 60 deg N have 10-40 times higher CO concentrations than the atmospheric equilibrium values. Measurements in the tropopause region of the northern hemisphere show rapid decrease of CO above the tropopause. Measuring methods made use of the chemical reaction between carbon monoxide and mercuric oxide at 210 C, using an optical cell to analyse the resulting mercury vapor. The recording program was begun late in 1967 at Mainz, and was repeated several times in 1968 and 1969. Upper troposphere measurements were made with commercial airplanes flying between Frankfurt, Germany, and Tokyo, Japan, on four trips lasting 18 hours each. Flight levels varied between 8,000 and 10,000 meters. Oceanic surface measurements were made during the Atlantic Expedition of the 'Meteor' in 1969.

2071 APTIC NUMBER 20215

Semenov, A. D., L. I. Nemtseva, T. S. Kishkinova and A. P. Pashanova
ORGANIC SUBSTANCES IN ATMOSPHERIC PRECIPITATES. (Ob organicheskikh veshchestvakh atmosfernykh osadkov). Text in Russian. Doklady Akad. Nauk SSSR, 173(5):1185-1187, 1967. 13 refs.

Results from determinations of the organic compound content in rain and snow samples taken throughout the USSR are presented. Tests were made for organic carbon and nitrogen, free amino acids, protein substances, amines, reducing sugars, polysaccharides, organic acids, and esters. Some samples were also tested for organic phosphorous and aldehydes. Organic carbon was found in quantities of 2.1-24 mg/liter in rain and 2.5-7.2 mg/l in snow. Organic nitrogen content measured 0.7-5.0 and 0.7-2.9 mg/l, respectively. Phosphorous content ranged 0.01-0.12 mg/l. Free amino acids were found in rain water in amounts of 9 to 50-60 mug/l, while the protein content exceeded these values by 3-4 times. Amine content in rain water was 3-35 mug/l; in snow, 2-6 mug/l. The concentration of reducing sugars ranged 230-1800 and 120-330 mug/l for rain and snow, respectively. Polysaccharide content was 80-1100 (rain) and 50-480 (snow) mug/l. Organic acid content amounted to 18-300 (rain) and 24-110 (snow) mug-equiv/l; the following were detected: acetic (predominant), butyric, valeric, and capronic. Ester content was 18-70 (rain) and 24-57 (snow) mug-equiv/l. Aldehyde content was 120-200 (snow) and 250-600 (rain) mug/l (referred to acetaldehyde). Urea was detected in amounts of 0.2-0.3 mg/l.

2072 APTIC NUMBER 12323

Stratmann, H. and M. Buck
SULFUR DIOXIDE EMISSION MEASUREMENTS IN THE STATE OF NORTH-RHINE-WESTPHALIA. (Schwefeldioxid-Immissionsmessungen im Lande

Nordrhein-Westfalen). Schriftenreihe Landesanstalt Immission- und Bodennutzungsschutz Landes Nordrhein-Westfalen (Essen), no. 3, 53p., 1966. 10 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 22p.

First-year operation of a sulfur dioxide concentration monitoring network covering a 5000 sq km area is described and findings are reported. Some 5000 measuring stations were involved and were distributed at 1-km intervals in a rectangular coordinate array with certain variations for practical reasons. Twenty-six measurements were made at each station during the year. Sampling sequences and data processing procedures are explained. Results of this study are tabulated and maps showing SO2 emission parameters are presented.

2073 APTIC NUMBER 20089

Suzuki, Noboru
STUDIES ON STATISTICAL PHENOMENA IN HYGIENIC CHEMISTRY AND THEIR APPLICATION. 20. STATISTICAL ANALYSIS OF DATA OBTAINED ABOUT AIR POLLUTION AT YOSHIWARA AREA IN SHIZUOKA PREFECTURE. (Eiseikagaku ryoiki niokeru tokeigensho to sono oyo nikansuru Kenkyu. (dai 20 p.). Shizuokakeu yoshiwarachiku niokeru taikiosen sokuteiseiseki no tokeigakuteki Kaiski). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 16(2):90-95, 1970. 6 refs.

The degree of air pollution in Yoshiwara district, Shizuoka Prefecture, was compared with that of Shizuoka City. Pollution was greater in the Yoshiwara area, and the quantity of fallout components appeared to be increasing year by year. Correlations between various fallout data were clarified and a regression equation was calculated for items with a strong correlation. The degree of correlation between sulfur trioxide and fallout components was examined and the distribution of SO3 and fallout components was clarified. Concentrations of SO3 in Yoshiwara were about one-half that in Yokkaichi and showed morning and afternoon maximums.

2074 APTIC NUMBER 20205

Texas State Dept. of Health, Austin, Div. of Occupational Health and Radiation Control
AIR QUALITY SURVEY OF AUSTIN, TEXAS, JUNE 1967. Texas State Dept. of Health, Austin, Div. of Occupational Health and Radiation Control, 45p., Feb. 1969. 7 refs.

An air sampling program monitoring particulate matter, sulfur dioxide, nitrogen dioxide, hydrogen sulfide, total hydrocarbons, aldehydes, and ozone was conducted in June 1967 in the Austin area. Twenty-seven sampling sites were chosen in representative locations. Suspended particulate material was collected on 8 inch by 10 inch glass fiber filters. Continuous monitoring for gaseous pollutants was conducted at the mobile laboratory. Sulfur dioxide determinations were also made at other sites. An analyzer employing a conductivity measurement technique was used for the continuous monitoring, while the West-Gaeke method was used for the short term samples. Tape samplers which exposed a lead acetate impregnated paper tape to a stream of air were used for the hydrogen sulfide measurements. Light transmission measurements were made to determine the percent decrease in transmission caused by the formation of lead sulfide. Nitrogen dioxide was measured by exposing the air to a sulfanilamide solution containing (N(-1-Naphtyl)ethylenediamine dihydrochloride) to obtain a color change which was then measured by a photocell. Determinations of total hydrocarbons were made with a Beckman analyzer which ionizes the carbon atoms in a hydrogen flame. Ozone was measured with a Beakman analyzer utilizing an electrochemical cell. Suspended particulate samples collected during the survey ranged from 21 micrograms/cu m to 236 micrograms/cu m with a geometric mean value of 56 micrograms/cu m. More than 97% of all particulate samples collected showed concentrations of less than 125 micrograms/cu m. Gaseous pollutants generally showed low concentrations. All SO2 concentrations measured were below 0.05 ppm. Total hydrocarbon measurements showed hourly averages of 1 ppm to 5 ppm. Nitrogen dioxide and aldehyde levels each ranged from 0.002 ppm to 0.006 ppm. In view of these results, the Austin metropolitan atmosphere is relatively unpolluted. Higher levels are expected, however, for fall and spring.

2075 APTIC NUMBER 20071

VARONIER Hubert S.
STUDY OF THE AERO-ALLERGEN POTENTIAL (DUE TO POLLEN AND FUNGI) IN GENEVA. (Etude du potentiel aero-allergenique (pollinique et fongique) a Geneve). Text in French. Acta Allergol., 24(6): 410-420, Dec. 1969. 16 refs.

A Durham gravity sampler was used to study aero-allergens in Geneva, Switzerland, during the months March-October in the years 1967 and 1968. The collecting site was in the center of the urban area and at an altitude of 400 meters. Each day, between the hours of 8 am and 9 am, the exposed samples were taken to the laboratory. A total of 18 types of pollen and 6 types of fungal spores were reported. From March to May, tree pollen predominated (willow, elm, and hazel in March; beech, birch, and ash in early April; chestnut and poplar toward the end of April). Grass pollen was most significant in May and June, with relatively small amounts of weed pollen July-September. Mold spores reached high peaks in July and in August, with a smaller peak in October, of which the most numerous type was Hormodendrum.

2076 APTIC NUMBER 20027

Waller, R. E. and B. T. Commins
STUDIES OF THE SMOKE AND POLYCYCLIC AROMATIC HHYDROCARBON CONTENT OF THE AIR IN LARGE URBAN AREAS. Environ. Res., 1(4):295-306, Dec. 1967. 14 refs.

The techniques used to assess average concentrations of smoke and polycyclic hydrocarbons in four cities in Europe (Belfast, Dublin, Oslo, and Helsinki) having populations of about half a million each are described. The work formed part of an international study of air pollution, smoking habits, and occupation in relation to lung cancer mortality. Concentrations of the pollutants measured were higher in Belfast than in Dublin and higher in Oslo than in Helsinki. No simple relationship between air pollution and lung cancer was discovered. Cigarette smoking was the most important factor in the etiology of cancer.

The relevance of these results to the recently published epidemiological findings is discussed. Changes in the amounts of pollution in each city in recent years might have made it difficult to assess past exposures on the basis of current concentrations. (Author summary modified)

2077 APTIC NUMBER 17986

Yunghans, Roland S. and Thomas B. McMullen
AMBIENT AIR FLUORIDE CONCENTRATIONS IN THE UNITED STATES.
Preprint, Public Health Service, Cincinnati, Ohio, National Air Pollution Control Administration, 18p., Aug. 1969. 8 refs.

The total water soluble fluoride concentration was determined in samples of suspended particulate matter collected through an air surveillance network in 1966 and 1967. A fluoride-selective electrode method was used which is suitable for anlayzing a large number of samples. Results of analyzing over 5400 samples from urban stations, and over 1400 samples from nonurban stations are summarized. Eighty-seven percent of all measurements at urban stations showed concentrations below 0.05 micrograms/cu m, the threshold of detectability. Thirteen measurements (0.2% of urban samples) exceeded 1.00 micrograms/cu m; the maximum was 1.89 micrograms/ cu m. Ninety-seven percent of all measurements at nonurban stations showed no detectable amounts of fluoride. Three nonurban samples (0.2%) contained fluoride concentrations exceeding 0.10 micrograms/cu m; the maximum was 0.16 micrograms/cu m. The maximum fluoride levels found were well below most of the published standards for a 24-hour average concentration of soluble fluoride, as HF (10 micrograms/cu m in the U. S. S. R. and Czechoslovakia; 7 micrograms/-cu m in Montana; 5 micrograms/ cu m, in Pennsylvania; and 3.3, 1.61 and 0.8 micrograms/cu m in industrial, urban, and rural areas of New York State). No geographic patterns were evident, nor did the data cover a long enough period to reveal trends. Generally it can be said that airborne water soluble fluoride concentrations are not approaching the currently acknowledged thresholds that would cause concern for human well-being. (Author abstract modified)

# ATMOSPHERIC INTERACTION

2078 APTIC NUMBER 18192

TECHNIQUES EMPLOYED IN FORECASTING AIR POLLUTION POTENTIAL. Air Eng., 8(10):22-23, Oct. 1966.

Criteria for and the method of forecasting air pollution potential are explained. Air pollution potential forecasts are based on meteorological data obtained from 70 weather bureau stations in the United States. When conditions warrant it, advisories are released from Cincinnati. Isolines on a map of the U. S. show the total number of days that advisories of high air pollution potential have been in effect in the east and the west. Most of the episodes evaluated were well verified by air quality data taken concurrently, thus lending credibility to the forecasts.

2079 APTIC NUMBER 20075

Baroni, A.
THE ROLE OF METEOROLOGY IN COMBATTING AIR POLLUTION IN URBAN AREAS. (Il ruolo della meteorologia nella lotta contro l'inquinamento atmosferico nelle zone urbane). Text in Italian. Riv. Meteorol. Aeronaut., 30(1):50-59, March 1970. 11 refs.

Urban areas have meteorological problems to which the findings in rural locations do not necessarily apply. Recent realization of this has led to the initiation of a number of urban studies, none of which have as yet provided quantitative data. In the United States, the emphasis is on formulating 'air pollution potential' which seeks to establish a set of criteria based on large-scale meteorological observations that could apply across the board for urban situations, regardless of the geography or topography of the area involved. In the United Kingdom, the current research emphasis is on 'air pollution warnings' issued when it is foreseen that a certain combination of meteorological conditions could lead to a particular level of pollution.

2080 APTIC NUMBER 20042

Berlyand, M. Ye., Ye. G. Genikhovich, and O. I. Kirenbin.
EFFECT OF RELIEF ON PROPAGATION OF POLLUTANTS FROM SOURCES. (Vliyaniye rel'efa na rasprostraneniye primesi ot istochnikov). Text in Russian. Tr. Glav. Geofiz. Observ. (Leningrad), no. 234:28-44, 1968. 17 refs.

A further development of earlier work on evaluating the effect of local surface irregularities in calculations of a pollutant concentration field is presented. A more rigorous model is employed together with analysis of pollutant propagation in a potential (rather than real) flow. Field work carried out at the Shchekino Regional Power Station is used as the basis for a sample analysis.

2081 APTIC NUMBER 20839

Berlyand, M. E.
ON DISTRIBUTION OF ATMOSPHERIC ADMIXTURES IN TOWN CONDITIONS. (O rasprostranenii atmosfernykh primesei v usloviyakh goroda). Text in Russian. Meteorol. i Gidrol., no. 3:45-57, 1970. 43 refs.

Problems of variations in urban meteorological regions are considered, among them the formation of heat islands at the center of a city, increased frequency of fog, lifted inversions, and surface calms. Atmospheric diffusion is theoretically investigated with special reference to open and flat terrain. Applicability of the results to characteristic admixture dissipation in urban conditions is discussed. Characteristics of atmospheric diffusion and the factors determining the dissipation of an admixture due to high and low sources in cities are analyzed. (Author abstract modified)

2082 APTIC NUMBER 20852

Danielsen, E., R. Bleck, J. Shedlovsky, A. Wartburg, P. Haagenson, and W. Pollock
OBSERVED DISTRIBUTION OF RADIOACTIVITY, OZONE, AND POTENTIAL VORTICITY ASSOCIATED WITH TROPOPAUSE FOLDING. J. Geophys. Res., 75(12):2353-2361, April 20, 1970. 4 refs.

On April 25, 1969, four RB-57 aircraft were used to obtain simultaneous measurements of radioactivity and ozone in the lower stratosphere and upper troposphere where a folded tropopause structure was predicted. Continuous measurements of ozone mixing ratio and frequent point sampling of radioactivity confirmed a positive correlation between these two stratospheric tracers on both the macroscale and mesoscale in the vicinity of a folded tropopause. The potential vorticity derived by objective analysis of isentropic surfaces had the same macroscale pattern as the tracers. A mesoscale analysis was not possible because the radiosondes do not provide the necessary horizontal resolution of mesoscale wind fluctuations. The tropopause was concluded to be triply-folded in this case. (Author abstract modified)

2083 APTIC NUMBER 20034

Dmitriyev, A. A. and G. M. Abakumova
EFFECT OF URBAN AEROSOLS ON THE TRANSMISSION COEFFICIENT OF THE ATMOSPHERE. (Vliyaniye gorodskikh aerozoley na koeffitsiyent prozrachnosti atmosfery). Text in Russian. Vestn. Mosk. Univ. Ser. V Geogr., no. 1:52-58, 1969. 3 refs.

Studies made at the Meteorological Observatory at the Moscow State University, and in the town of Sobakino during the years 1955 through 1964, are reported. Annual fluctuations in the transmission coefficient were essentially the same for the two observation points, decreasing rather uniformly form a value of about 0.78 in November to about 0.70 in July, when it began to

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rise again sharply. The difference between maximum and minimum values was the same at both locations (0.084); the monthly average value was 0.020 lower at the Meteorological Observatory, reflecting the effect of urban aerosols. Greatest aerosol effects were detected in the spring-summer period. Methods of statistical treatment are presented.

2084 APTIC NUMBER 11614

Drayson, S. R., S. Y. Li, and C. Young
ATMOSPHERIC ABSORPTION BY CARBON DIOXIDE, WATER VAPOR AND OXYGEN. (FINAL REPORT). Mich. Univ., Ann Arbor, High Altitude Engineering Lab., National Environmental Satellite Center Environmental Science Services Administration Contract Cwb-11376, ORA Proj. 08183, 39p., Feb. 1968. 53 refs.
CFSTI: PB 178068

The carbon dioxide absorption bands between 12 and 18 micron are of great importance for atmospheric long wave radiative transfer. Theoretical calculations require an accurate knowledge of the frequencies, intensities, and half-widths of the individual absorption lines. The method of calculating the frequencies and relative intensities is described, including tables of the necessary parameters. Band intensities and half-width are deduced from high and low resolution experimental spectra. Comparisons between the experimental and theoretical data are presented, showing generally satisfactory agreement. Also presented are the results of partially completed studies of the rotational water vapor band and the oxygen 'A' band. (Author abstract modified)

2085 APTIC NUMBER 20858

Duetsch, H. U.
ATMOSPHERIC OZONE - A SHORT REVIEW. J. Geophys. Res., 75(9):1707-1712, March 20, 1970. 7 refs.

Measurements of the vertical ozone distribution give an explanation of the discrepancy between the observed variation of the total amount as a function of season and latitude and the results of the photochemical theory which predicts a maximum at high sun. The late winter and spring maximum of total ozone, which is observed at high latitudes, is found to be produced by its accumulation in the lower stratosphere. The tropical deficit is apparently due to the low ozone content of the high reaching low-latitude troposphere. The strongest latitudinal gradient in ozone concentration thus exists between 15 and 20 km. When ozone was used as a tracer in a numercial 18-level general circulation experiment the poleward flux at low latitudes appeared to be mainly produced by an extension of the Hadley cell into the tropical and subtropical stratosphere. Further poleward transport is generated by large-scale eddies and may be reduced by an indirect cell at high latitudes. Difficulties with the photochemical theory of ozone, namely uncertainties about the quantitative influence of reactions with hydrogen-containing radicals, at present endanger the effectiveness of tracer studies.

2086 APTIC NUMBER 18201

Georgii, H. W.
CONTRIBUTION TO THE SULFUR CYCLE BY SO2 AND SULFATE MEASUREMENTS IN THE OPEN ATMOSPHERE. (Beitrag zum Schwefelhaushalt auf Grund von SO2- und Sulfatmessungen in der freien Atmosphaere.) Text in German. Umschau (Berlin), 68(18):565-566, Aug. 29, 1968. 2 refs.

Since knowledge of the distribution of sulfur compounds in the troposphere is too incomplete to permit any conclusions about large-scale transport phenomena and how stratospheric sulfur concentrations are affected, measurments of the vertical SO2 and SO4 distribution were taken from an airplane. First results of these measurements had been published earlier by this author (Umschau 1966, p. 96). Comparative measurements taken above the North Sea and in the clean air of Colorado showed that the SO2 concentrations found in Central Europe, which were 3 to 5 times higher than in clean air, were also found in areas outside the reaches of SO2 sources. Parallel measurements of SO2 concentrations and aerosol-bound sulfate should provide information on any changes in the SO4(2-)/SO2 concentration ratio, which at ground level is about 1:1 to 1:2 in unpolluted air and depends on height. The measurement flights so far have brought the following results: In the lower atmosphere, SO2 is predominate and the SO4(2-) concentration is much lower. Above inversions or layers of haze, the SO2 concentration drops, while the SO4(2-) concentration is little influenced. The SO4(2-)/SO2 ratio jumps from values below 1 to values above 1. Contrary to measurements in Germany, measurements in the dry air of Colorado showed that the SO4(2-)/SO2 ratio was to a large extent independent of height. The changes found in Germany can be explained by the SO2-NH3 liquid water reaction.

2087 APTIC NUMBER 20177

Gushchin, G. P.
SPECTROPHOTOMETRIC STUDY OF CHARACTERISTICS OF ATMOSPHERIC AEROSOL IN VARIOUS GEOGRAPHIC REGIONS OF THE USSR. (Spektrofotometricheskiye issled-ovaniya kharakteristik atmosfernogo aerozolya v razlichnykh geografi-cheskikh rayonakh SSSR). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 223:65-80, 1968. 7 refs.

Spectophotometric studies of atmospheric aerosols at wavelengths of 369 and 530 nm carried out at 38 stations throughout the USSR are reported. Measurements were made with the M-83 ozonometer and aerosol optical thickness values are tabulated for various dates and times of day at Voyeyskovo, Karadya, Bol 'shaya Yelan', Murmansk, Kuybyshev, and Dushaibe. Aerosol optical thickness decreased with increasing wavelength.

2088 APTIC NUMBER 20152

Gyllander, Ch., S. Hollman, and U. Widemo
DIFFUSION FROM A GROUND LEVEL POINT SOURCE. EXPERIMENT WITH THERMOLUMINESCENCE DOSIMETERS AND Kr 85 AS TRACER SUBSTANCE. Aktiebolaget Atomenergi (Stockholm), AE-353, 22p., 1969. 8 refs.

Diffusion experiments with Kr85 as a tracer substance and beta-sensitive dosimeters were carried out in Tranvik valley south of Trobbofjaerden, near the Baltic. Dose distributions were studied 50 and 200 m from the release point. At each level, the horizontal and vertical dispersion parameters were experimentally determined and their conformity to normal distribution was calculated. The experiment was made under ideal weather conditions above snow-free ground. The horizontal difffusion parameters obtained from the experiment were somewhat smaller than the theoretical values, while good agreement was found for the vertical diffusion parameters. The most noticeable difference occurred between the I-factors (I is a function of the direction coordinate x obtained from the equation of continuity) which were calculated on the basis of the values obtained for the vertical and horizontal diffusion parameters and the concentration at the plume centre line. The dose distribution was approximately normal as verified by an x2 test. Dilution factors were 3.7 to 5 times greater than those arrived at theoretically, based on data obtained from the main meteorological tower. A safety analysis showed that the dose to a person at the plume centre and at a distance of 1300 m was 0.1 mrem.

2089 APTIC NUMBER 20869

Huss, A., M. Segal, and G. Assaf
MODEL INVESTIGATION OF THE TIME-DEPENDENT DISTRIBUTION OF RADON.
J. Geophys. Res., 75(15):3020-3026, May 20, 1970. 9 refs.

A previous scale analysis, in which steadiness and uniformity were assumed, indicated that the distribution of radon in the atmosphere is sensitive to the divergence regime and might be used as a measure of the vertical wind on the synoptic scale. The purpose of the present study was to substantiate this approach by determining how the schematic distribution of radon would look in regions in which horizontal divergence or convergence dominate. A three-level quasi-state and quasi-geostrophic model was chosen to obtain a three-dimensional time-dependent radon distribution. The model generated a streamline field at three levels and vertical velocities at two levels. Several numerical experiments were performed in which radon was introduced at the lowest level. The sources were distributed uniformly over the whole region or over half of the total region. The distribution of radon responded quite realistically to the large-scale atmospheric flow and particularly to the convergence-divergence patterns, i.e., to the distribution of the vertical components of the motion. Distribution was almost unaffected by the prevailing flow patterns at the moment at which radon was first introduced into the model atmosphere. (Author abstract modified)

2090 APTIC NUMBER 20060

Idso, Sherwood B. and Paul C. Kangieser
SEASONAL CHANGES IN THE VERTICAL DISTRIBUTION OF DUST IN THE LOWER TROPOSPHERE. J. Geophys. Res., 75(12):2179-2184, April 20, 1970. 13 refs.

Although the mean transmittance difference for solar radiation measurements at two elevations in Phoenix differing by 464 meters is 0.012 for May-August and 0.066 for November-February, the transmittance of the atmosphere yield is probably very similar, if it is assumed that atmospheric dust is confined to the surface layer in winter but is more evenly distributed to a height of 3,000 meters in the summer. Measurements were made with an Eppley pyranometer and two silicon-cell solar radiometers on nearly every clear day between July 1968 and June 1969. Pyranometer readings were corrected for ambient temperature and solar zenith angle effects. A similar study has been made in Germany by Reeger and Siedentopf, who measured vertical profiles of dust concentration on ascending and descending aircraft flights. The decrease in particle count was approximately exponential in terms of elevation; the value of 1/e was 300 m in winter flights and 1300 m in summer flights, which they explained as the result of a strong vertical exchange in the summer.

2091 APTIC NUMBER 20180

Ivlev, L. S., A. S. Bursakova, and O. M. Surikov.
MEASURING THE GROUND-LAYER DISTRIBUTION OF ATMOSPHERIC AEROSOL. (Izmereniya raspredeleniya atmosfernogo aerozolya v prizemnom sloye). Text in Russian. Probl. Fiz. Atmo., no. 6:77-78, 1968.

Preliminary treatment of systematic measurements made in the vicinity of the city Ryl 'sk in the summer of 1967 indicate two basic types of aerosol distribution in the ground layer: Yungovskiy-type distribution for particle radii ranging 0.1-1.5 micron; and distributions with a minimum count concentration for particle radii ranging 0.25-0.6 micron and a slight maximum for particles with radii ranging 2-3 micron. Aerosol concentration in the evening hours depends significantly on air temperature and temperature on the underlying surface measured at noontime, indicating the greater importance of convection over condensation in establishing aerosol distribution in the ground layer. The aerosol vertical profile showed a maximum at around 1 m and an absence of particles greater than 1 micron in radius at heights of 5-20 m. A more detailed analysis is forthcoming.

2092 APTIC NUMBER 20197

Johnston, Harold S.
PHOTOCHEMICAL OXIDATION OF HYDROCARBONS. Ind. Eng. Chem., 48(9):1488-1491, Sept. 1956. 13 refs.

Photochemical reactions in smog produce free radicals which constantly recombine through bimolecular collisions. Steady-state partial pressures and half lives were estimated for various degrees of sunlight absorption. From estimates of the amount of solar energy absorbed to produce free radicals, the steady-state partial pressure of free radicals was 0.3 to 3 ppbm, or about 1 to 10% of the partial pressure of the molecular contaminants. This suggests that free radicals themselves are important primary irritants. The half life with respect to recombination is 10 to 100 seconds, or long enough for extensive penetration of free radicals into buildings.

2093 APTIC NUMBER 20193

Junge, C. E.
AIRBORNE DUST AT BARBADOS AND ITS RELATION TO GLOBAL TROPOSPHERIC AEROSOLS. Geochim Cosmochim. Acta, vol. 32:1219-1222, 1968. 6 refs.

Data on airborne dust collected at Barbados are compared with meteorological data on tropospheric aerosols. The size distribution of the Barbados particles is plotted together with sets of data for essentially clean air. The data refer to different size ranges, depending on the location and the method. Two curves were obtained over Central Europe where particles between 10 and 100 micron predominate. A third curve was computed for an optical turbidity factor of two from measurements of the scattering function around the sun in a clean atmosphere. The distribution refers to a uniform aerosol of background character. Other curves represent aerosol distribution over Crater Lake in the presence of Pacific air and during periods of subsidence. All the distributions fall within a relatively narrow band of a rather uniform slope. The slopes suggest that aerosol distribution in the upper half of the atmosphere is not much more uniform than in surface layers. The size distribution of the tropospheric aerosols are thought to represent quasi-steady states between sources and sinks within the troposphere on a global scale. Other data obtained at Barbados show that sea salt particles contained dust originating in dust clouds over northern Africa. It is concluded that the size distribution of such dust clouds differs from that of the background aerosols, and that the difference must be considered in evaluating airborne dust in deep-sea sediments.

2094 APTIC NUMBER 17941

Kelenffy, Szilveszter, Jozsef Morik, and Tibor Varkonyi
VERTICAL PROAGATION OF AIR POLLUTION. (A varosi levego szennyezodesenek vertikalis terjedese). Text in Hungarian. Idojaras (Budapest), no. 5:268-270, 1967. 11 refs.

The occurrence of air pollution in the lower atmosphere was studied by means of instrumented aircraft. Concentrations of solid aerosols were greatest in the lowest layers and decreased rapidly as altitude increased. In gaseous pollution, the vertical decrease was less pronounced, and many cases were found where maximum concentrations occurred at altitudes of several hundred meters. In an investigation of the occurrence of bacteria, the number of microorganisms even at 200 m altitude was only a fraction of the value found in the vicinity of the ground; above cloud level, this number decreased to very low values. Near the ground, cocci prevailed; aloft, the aerobial germs were more numerous. Air pollution over industrial areas frequently showed a stratified structure related to temperature inversions. From aircraft, pollution from individual industrial sources could be followed in a horizontal direction often to distances of 10 to 30 km. (Author abstract modified)

2095 APTIC NUMBER 20801

Kigoshi, Kunihiko and Kazuo Yoneda
DAILY VARIATIONS IN THE TRITIUM CONCENTRATION OF ATMOSPHERIC MOISTURE. J. Geophys. Res., 75(15):2981-2984, May 20, 1970. 5 refs.

Daily variations in the tritium concentration of atmospheric moisture were observed in Tokyo from May 10 to June 2, 1966 and from July 12 to August 6, 1968. Sampling was carried out with a dehumidifier placed 12 meters above the ground, and a 150-ml portion of the total water collected within 24 hours was used for measurement of tritium following tritium enrichment by electrolysis to about 30 times its original concentration. Radioactivities of the enriched tritium samples were measured by ethane-gas counting. An increase in tritium concentration corresponded to a change in air mass from an oceanic continental origin, accompanying the movement of a front from the north. However, the difference in the tritium content of moisture in air masses separated by a front was not so sharp as indicated by the changes in weather. The tritium concentration in a tropical low-pressure air mass accompanying the arrival of a typhoon from the South Pacific was nearly equal to the level of tritium in surface ocean water. Short-term variations in tritium concentration of atmospheric moisture at ground level are good indices of air-mass movements in and near coastal areas.

2096 APTIC NUMBER 20842

Krey, P. W. and B. Krajewski
COMPARISON OF ATMOSPHERIC TRANSPORT MODEL CALCULATIONS WITH OBSERVATIONS OF RADIOACTIVE DEBRIS. J. Geophys. Res., 75(15): 2901-2908, May 20, 1970. 27 refs.

A semi-empirical box model of atmospheric transport that permits the calculation of stratospheric inventories, surface air concentrations, and deposition of debris injected into the stratosphere, mesosphere, or higher levels was developed. The model divides the atmosphere of each hemisphere into three compartments: the atmosphere above 21 km, the atmosphere below 21 km, and the troposphere. The transfer between compartments follows first order kinetics, although the season and height of injection regulate the onset of the transfer. The model adequately computed the fallout parameters of the specific injections of Rh(102), Cd(109), Pu(238), and Sr(90) from the 1961-1962 tests, and Sr(90) from the sixth Chinese nuclear test in June 1967. It also predicted the 1969 fallout from recent atmospheric tests. (Author abstract)

2097 APTIC NUMBER 20845

Kummler, Ralph H. and M. H. Bortner
SINGLET OXYGEN IN POLLUTED ENVIRONMENTS. J. Geophys. Res., 75(15):3115-3122, May 20, 1970. 55 refs.

The role of singlet oxygen in the troposhere is considered at concentration of the order of the steady state between the sources and the sinks. The production terms evaluated include the collisionally induced absorption of solar energy, the Hartley photolysis of ozone, exothermic chemical reaction, and energy transfer from triplet states of organic molecules. The triplet states of organic molecules are a large potential source of singlet oxygen if the quantum yield approaches unity. The major

sink for singlet oxygen is quenching. Recent experimental values for singlet oxygen quenching are employed to obtain steady-state concentrations of singlet oxygen. The minimum concentrations of singlet oxygen so obtained are sufficiently high to affect the oxidation of olefins, and they may play an important role in explaining the infamous material imbalance in chamber studies if the actual concentrations are somewhat higher. The role of singlet oxygen in the conversion of nitrogen oxide to nitrogen by the Pitts mechanism is also discussed. (Author abstract modified)

2098 APTIC NUMBER 20846

Ludwig, F. L. and Elmer Robinson
OBSERVATIONS OF AEROSOLS AND DROPLETS IN CALIFORNIA STRATUS.
Tellus (Uppsala), 22(1):94-105, 1970. 28 refs.

A program of aerosol and cloud droplet measurements in stratus clouds was carried out during the summer of 1968 south of San Francisco. Size distributions were determined with a Royco light-scattering particle counter, a condensation nuclei counter, and a settling tunnel. The size distribution data show a mode in the submircon size range. Secondary modes appear at radii of about 6 to 8 micron in developed clouds and at somewhat smaller sizes during periods of cloud dissipation. The aerosol below the cloud did not show the secondary mode at the larger sizes. Observations show organic material to be present and a nonuniformity in the distribution of sulfur compounds and chlorides over a droplet spectrum. The results of other studies of fog and stratus droplets are reviewed. (Author abstract modified)

2099 APTIC NUMBER 20156

McCormick, Michael Patrick
LASER BACKSCATTER MEASUREMENTS OF THE LOWER ATMOSPHERE. William and Mary College, Williamsburg, Va., Dept. of Physics, Thesis (Ph.D.), Ann Arbor, Mich., Univ. Microfilms, Inc., 1967. 174p. 36 refs.

Laser backscatter measurements of the atmosphere made at William and Mary College to a height of 28 km and using a wavelength of 6943 A demonstrated the ability of laser radar to give an accurate quantitative description of the particulate and molecular content of the atmosphere. The Mie and Rayleigh theories were used to calculate absolute volume backscatter, cross sections, and attenuation coefficients for the aerosol and molecular components, respectively. Results show a generally excellent agreement with aerosol number density Model II, suggesting that the atmospheric aerosol concentration decreases exponentially with height to an elevation of 5 km, remains fairly constant from 5 to 12 km, then increases to a relative maximum near 18 km. Such results are consistant with the Jungle fourth power sized distribution law and with the direct samplings of atmospheric aerosol made by Rosen. Various meteorological phenomena were observed, which demonstrate the potential application that can be made with laser radar in meteorological studies.

2100 APTIC NUMBER 20848

McGinnigle, J. B.
A NOTE ON OBSERVED DUST-WHIRL DAMAGE AT NICOSIA CYPRUS. Meteorol. Mag. (London), 99(1173):118-122, April 1970. 2 refs.

The damage done by a dust whirl of considerable intensity in Nicosia, Cyprus is documented. Records of wind speed and direction made by the nearest meteorological observation station clearly indicate pre-frontal fluctuations and steady onset of the wind. Dust whirls occur commonly in central Cyprus, but this one was of greater vertical development and travelled differently than the standard ones.

2101 APTIC NUMBER 20064

Mery, P.
SIMULATING DIFFUSION IN THE ATMOSPHERIC BOUNDARY LAYER.
(Reproduction en similitude de la diffusion dans la couche limite atmospherique). Text in French. Houille Blanche, no. 4:327-344 1969. 29 refs.

Similarity criteria were established for wind-tunnel simulation of the dispersion of smoke plumes from industrial chimneys. Investigation of plume behavior revealed the influence of atmospheric conditions and conditions governing emissions from the pollution source. The scope of the model was extended by showing the parameters governing the behavior of an effluent plume and the similarity criteria to be deduced therefrom. Suitable simulation techniques are reviewed, and the features of a suitable wind-tunnel for scale investigations of turbulent atmospheric diffusion are described.

2102 APTIC NUMBER 12349

Monin, A. S.
ON THE TURBULENT EXCHANGE ABOVE OCEANS. (O turbulentnom obmene nad okeanami). Doklady Akad. Nauk. SSSR, 175(4):819-822, 1967. 3 refs. Translated from Russian. Franklin Inst. Research Labs. Philadelphia, Pa., Science Info. Services, 8p

The humidity of air exerts a considerable influence on the turbulent state of the lower layer of air above the ocean (as well as above very wet land areas). It affects the magnitude of the gravitational force in the first place; in the second place, at high moisture contents, air strongly absorbs radiation of long wave-lengths, so that the heat influx due to this process must be taken into account. The turbulent entropy flux in humid air is not proportional to the turbulent heat flux, as it is in dry air, but includes a turbulent flux of moisture as well. The latter has apparently been over looked up to now. Using analytical expressions incorporating terms representing the effect of moisture, as well as heat flux, energy, and momentum equations, expressions are derived characterizing the velocity, temperature and humidity profiles of the lower layer of air above the ocean; taking the statistical homogeneity of the undulating ocean surface into account and restricting them to steady-state conditions. Particular cases are considered in which the expressions for the dimensionless functions used to characterize the above profiles

assumes forms which agree with experimentally determined profiles in these particular cases.

2103 APTIC NUMBER 20084

Nagao, T., M. Takeuchi, T. Otaki, and K. Fuchimoto
THE UPPER WIND DISTRIBUTION NEAR ICHIHARA CITY. PART II. (Ichiharashi kinbo no josofu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):101, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.) PART I. Ibid., 4(1):100, 1969.

Multivariate differential equations were developed which enable the calculation of wind velocity from the knowledge of the distribution of divergence and vorticity of the upper wind at various altitudes. The numerical results were plotted to indicate the movement of the upper wind for July 21, 1968 in the general area of Ichihara.

2104 APTIC NUMBER 20085

Nagao, T., M. Takeuchi, T. Otaki, and K. Fuchimoto
THE UPPER WIND DISTRIBUTION NEAR ICHIHARA CITY. PART I. (Ichiharashi kinbo no josofu). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):100, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.) PART II. Ibid., 4(1):101, 1969.

Pilot balloons were simultaneously released from nine points in Ichihara, Japan, in 1968 in order to obtain data on the upper wind. This simultaneous method yields a fairly accurate (in the order of degrees) measurement of wind direction compounded by the advantage that the wind under observation is independent of various lesser geographical features for at least within the 100 meter radius. By the mathematical analysis of the locational data of the balloons, the distribution of the divergence and the vorticity of the upper wind can be calculated.

2105 APTIC NUMBER 20068

Nakamura, A. and T. Masuda
OBSERVATIONS ON ASCENT OF SMOG LAYER AND ITS EFFECTS ON CONCENTRATIONS. (Emmuso josho no kansokurei). Text in Japanese. Taiki Osen Kenkyu (J. Japan Soc. Air Pollution), 4(1):99, 1969. (Proceedings of the 10th Annual Meeting of the Japan Society of Air Pollution, 1969.)

In a flat metrorolitan area such as Sapporo, Japan, where the source of air pollution in winter is mainly the smoke stacks for household and industrial heating, the dissolution of the inversion layer results in the rising of the stable layer; trapped by the unstable layer underneath, pollution increases in concentration with the emission increase. Furthermore, the pollutants reach the higher altitudes with the dissolution of the stable layer (expansion of the unstable layer). Several photographic observations and sulfur dioxide samplings were conducted during the winter of 1968-69.

2106 APTIC NUMBER 20047

Novikov, Yu. I. and V. A. Shnaydman
INFLUENCE OF A SMOKE SCREEN ON THE MICROCLIMATE OF THE GROUND LAYER OF AIR. (Vozdey-stviye dymovoy zavesi na mikro-klimat prizemnogo sloya vozdukha). Text in Russian. Meteorol. Klimatol. i gidrol., no. 3:46-53, 1968. 1 ref.

Three tests were carried out in the Belgorod-Dnestrovsk district on three nights in October 1965 using smoke-screens produced by a straight row of 15 smudge pots placed 3 m apart at the height of 5.10 and 0 m from the ground and consuming fuel at a rate of 5kg/m. hr. The wedge-shaped smoke cloud extended downwind, normal to the line source, in such a manner that at the distances of 50,100 and 200 m from the source at the 5 m height; its lower boundary was the heights of 3.5, 2.5 and 1 m, its thickness being 3.6, 5 and 10 m, respectively; from the source at the 10 m height, its lower boundary remained at 10 m, its thickness being 6 and 12 m; and from the source on the ground, its upper boundary was at the height of 6 to 7 m. The width of the smoke cloud increased from 45 m on the source line to 56 m at the distance of 100 m in the first two cases. Each test area was located 100 m downwind from the smoke source and a nearby noninfumated area was used as a control. In each test, the radiation balance, in cal/sq cm min, the ground temperature, in C, at depths of 0.05, 0.10, 0.15 and 0.2 m; and the air temperature, in C, at heights of 0, 0.02, 0.05, 0.10, 0.50, 2.0, 4.0 and 8.0 m, were recorded at 15-minute intervals, starting 1 hour before the beginning of the smoke generation and stopping 1 hour after its ending. The values of the radiation balance at the control areas were 0.110, 0.133, and 0.125 cal/sq cm. min. respectively, and the mean values of the ground and air temperatures at these areas are given. The mean radiation effect decreases linearly with the height of the linear source from 22% at h equals 0 to 7% at h equals 10 m, while the mean 'temperature effect' decreases with the source height from 0.6 to 0.4 C at h equal 0, to 0.4 to 0 C at h equals 5, to 0.2 C at h equals 10 m.

2107 APTIC NUMBER 20162

[illegible]
TABLES FOR DIRECT CALCULATION OF PARTICLE DISTRIBUTION DENSITY BY THE TRANSPARENCY METHOD. (Tablitsy dlya neposredstvennogo rascheta plotnosti raspredeleniya chastits metodom prozrachnosti). Text in Russian. Tr. Malchik. Vysoko. Geofiz. Inst., no. 8:94-125, 1968. 4 refs.

A 29-page table for converting atmospheric transparency values to particle distribution density is presented, together with the mathematical bases from which it was derived.

2108 APTIC NUMBER 20853

Perkins, R. W., C. W. Thomas, and J. A. Young
APPLICATION OF SHORT-LIVED COSMOGENIC RADIONUCLIDES AS TRACERS OF IN-CLOUD SCAVENGING PROCESSES. J. Geophys. Res., 75(15): 3076-3087, May 20, 1970. 11 refs.

Measurements of cosmogenic radionuclides Cl(38), Cl(39), and

Na(24) in consecutive rain water samples during storms have provided a basis for studying precipitation formation. These radionuclides, which result from cosmic ray spallation of atmospheric argon, 'label' the natural aerosols, and can thus serve as tracers of in-cloud scavenging. They are collected on cation and anion resin beds and are counted on multidimensional gamma ray spectrometers. Cloud droplets form on 'labeled' condensation nuclei. During subsequent growth of the cloud droplets through coalescence and condensation, additional collection of newly formed cosmogenic radionuclides appears to be small. During their in-cloud development, the raindrops may be subjected to several cycles of partial evaporation followed by further coalescence and condensation, particularly in light rains. Measurements indicate that light rains have spent a substantially longer period in their development than heavy rains. They show higher radionuclide concentrations and higher ratios of long-lived to short-lived radionuclide.

2109 APTIC NUMBER 11610

Plass, Gilbert N.
INFRARED ABSORPTION PROGRAM. (FINAL REPORT). Southwest Center for Advanced Studies, Dallas, Tex., DAR Contract AF19(628)-5039, Proj. 4076, Task 407604, Work Unit 40760402, AFCRL-68-0118, 11p., Feb. 28, 1968. 22 refs.
CFSTI: N68-24137

A number of aspects of the interaction of radiation with planetary atmospheres were studied. The variations to be expected in the transmission of radiation from thermal sources (continuous in wavelength), from flames (molecular bands), and from laser sources (essentially monochromatic) was derived. The scattering and absorption of Mie particles was studied because of the importance of aerosols in our atmosphere. Multiple scattering of light is important in any realistic model of the earth's atmosphere. A sophisticated Monte Carlo method was developed to follow the path of a photon as it is scattered or absorbed by collision with atmospheric molecules, aerosols, and water droplets. Results were derived from the Monte Carlo calculations for many different conditions. The radiant intensity, flux, and polarization were calculated at arbitrary levels in the atmosphere. (Author abstract modified)

2110 APTIC NUMBER 20166

Prasad, B. A. Deva Guru
WIND AND TEMPERATURE FLUCTUATIONS IN THE SURFACE LAYER.
Pennsylvania State Univ., University Park, Dept. of Meteorology, Thesis, (PH.D), Ann Arbor, Mich., Univ. Microfilms, Inc. 1967, 82p. 25 refs.

The 'similarity theory' is tested with data on the fluctuation quantities and mean values of wind speed components and temperature at a number of locations and levels at height extending several decameters from the surface of the ground. The magnitude of turbulent fluctuations, according to this theory, is a function of the stability ratio, which expresses the relationship of the height to the scaling length. In addition to data furnished by the U. S. Army Electronics Command, surface stress and vertical heat flux were measured directly at Round Hill. The fluctuations of the vertical component of wind speed and temperature obey the predictions of the theory, while fluctuations of the lateral and longitudinal components do not. Changes of atmospheric stability do not affect these fluctuations equally at varying heights. The ratio of the standard deviation of horizontal fluctuations in wind speed to the friction velocity seem to differ from one site to another. The standard deviation of the vertical angle fluctuations does not depend on stability at the lower levels. Fluctuations of azimuth angle decrease in magnitude with the height. For the longitudinal component of wind speed, the relative turbulene intensity decreases with height under all circumstances. Under unstable conditions, the normalized standard deviation of temperature fluctuations follows the universal flux-profile function of Dyer.

2111 APTIC NUMBER 20213

Pressman, A. Ya.
METHOD FOR CALCULATING DIFFUSION OF A HEAVY NONUNIFORM IMPURITY FROM A VOLUME SOURCE WITH WIND VARIABLE AND HEIGHT. (Model' dlya rascheta vypadeniya tyazheloy neodnorodnoy primesi iz ob 'emnogo istochnika pri vetre, izmenyayushchemsya a vysotoy). Text in Russian. Doklady Akad. Nauk SSSR, 181(5):1115-1118, May 1968. 6 refs.

This simplified method for calculating diffusion of nonuniform particles in air with wind velocity varying arbitrarily with height is based on previous work by the same author. Simplification consists of assuming that two of the original parameters remain constant at all levels while another parameter is set equal to zero.

2112 APTIC NUMBER 20862

Rosinski, J., C. T. Nagamoto, G. Langer, and F. P. Parungo
CIRRUS CLOUDS AS COLLECTORS OF AEROSOL PARTICLES. J. Geophys. Res., 75(15):2961-2973, May 20, 1970. 3 refs.

Water-insoluble aerosol particles larger than 2 micron in diameter in cirrus and other types of iced clouds were studied according to three classes: nonmagnetic particles, nonspherical magnetic particles, and magnetic spherules. Their respective concentrations were 10 to the 7th power, 10 to the 5th power, and 7700 particles per gram of ice. Although the concentration of the particles varied considerably within the cloud, generally similar size distributions were found for all three classes at various locations within a cloud. Particle concentration generally decreased with increasing particle size. The different size distribution of magnetic spherules found on some occasions indicates that their origin differs from that of the other classes. For further study, magnetic spherules were divided into four subclasses according to shape (spherical and oblong) and surface texture (smooth and rough). Though the average abundance of each subclass of spherules represent in cirrus is similar to that in air, very large differences may occur on some occasions. Chemical determinations of Ca, Na, Fe, and Ni were made for the nonmagnetic (nm) and magnetic (M) particles. Nickel was found in only 4 of 32 samples. Generally, the concentrations and

ratios of the elements were in the following increasing order: Fe, nm greater than m; Ca, m greater than nm; Na, m greater than nm; Fe/Ca, nm greater than m; Fe/Na, nm greater than m; and Ca/Na, m greater than nm. Magnetic aersols (including spherules) are rich in calcium, indicating that they are of terrestrial origin. A pronounced separation of different types of particles, and different Ca/Na ratios, depending on altitude, were found on some occasions within a cirrus cloud. Cirrus-induced rains yielded a maximum concentration of 2000 magnetic spherules per l of rain in some samples collected in Colorado, and 5000 per l in Minnesota. The preferential transfer of magnetic particles into the ice phase of cirrus clouds affects the estimated flux of extraterrestrial spherules based on sampling at the earth's surface. (Author abstract modified)

2113 APTIC NUMBER 20113

Schuck, E. A., A. P. Altshuller, D. S. Barth, and G. B. Morgan
RELATIONSHIP OF HYDROCARBONS TO OXIDANTS IN AMBIENT ATMOSPHERES.
J. Air Pollution Control Assoc., 20(5):297-302, May 1970. 15 refs.

When maximum daily oxidant values are plotted as a function of the early morning hydrocarbons, a complete range of oxidant values is observed; given data for a sufficient number of days, the maximum values of attainable oxidant are a direct function of the early morning hydrocarbon concentration. This upper limit of the maximum daily oxidant concentration is dependent on the metropolitan geographical area only to the extent that differences in meteorological variables exist between these areas, and the data from all cities can be plotted on one graph when defining the oxidant upper limits as a function of early morning hydrocarbon. The average 6:00-9:00 am nonmethane hydrocarbon concentration of 0.3 ppm carbon can be expected to produce a maximum hourly average oxidant concentration of up to 0.1 ppm.

2114 APTIC NUMBER 20850

Schuster, Burton G.
DETECTION OF TROPOSPHERIC AND STRATOSPHERIC AEROSOL LAYERS BY OPTICAL RADAR (LIDAR). J. Geophys. Res., 75(15):3123-3132, May 20, 1970. 12 refs.

Data obtained with the National Center for Atmospheric Research lidar system show stratification and temporal variations of optical backscattering due to atmospheric aerosols up to a height of 40 km. Short-lived (less than 4 sec) layers with thickness and spacing of 30 meters are routinely found throughout the range of observation. A well-defined layer of temporal stability of several hours is very often found at the tropopause. The so-called '20-km' sulfate layer is found to be subject to variations in altitude, thickness, and (under the assumption of non-varying size distribution and composition) concentration. Significant and quasi-stable layers exist between 25 and 40 km, including one at the 36-km level, which is postulated by preliminary calculations of Mateer to be responsible for the blue and white bands observed and photographed by astronauts. (Author abstract)

2115 APTIC NUMBER 18186

Sinclair, Peter C.
GENERAL CHARACTERISTICS OF DUST DEVILS. J. Appl. Meteorol., 8(1):32-45, Feb. 1969. 10 refs. (Presented in part at the 47th Annual Meeting of the American Meteorological Society, New York, Jan. 1967.)

The spacial distribution of dust devils indicates that dust devil occurrence for the two areas studied, the Tucson basin and the Avra Valley, reaches a maximum in the vicinity of dry river beds which lie in the lee of small hills. This may be due to the availability of loose surface material which is easily picked up and kept airborne by the dust devil winds, or higher soil surface temperatures. The mean number of dust devils per day varied from 50 for the Tucson basin to 80 for the Avra Valley. The Avra Valley census was taken in July, and this accounts for the greater dust devil frequency since there is increased convective activity from June to July. The diurnal variation for dust devil occurrence in both areas showed a period of maximum activity between 1300-1400 LST. The Avra Valley maximum occurs earlier than that of the Tucson basin due to differences in cloud cover and environmental wind speed. Data from both sites showed that duration increases with dust devil size. Regardless of size and location, approximately 90% of the dust devils have a duration of less than 3.5 minutes. These data have provided quantitative information on the relation of environmental conditions to the spacial distribution, frequency and duration of a particular type of dry atmospheric thermal. Diagrams of the relationships between dust devils and various environmental factors are included in the discussion, as well as maps of the areas studied.

2116 APTIC NUMBER 17964

Slater, Herschel H.
COMMENT ON 'KILLER STORMS'. Preprint, 3p., 1969 (?). 10 refs.

Comments are presented on an article titled 'Killer Storms' by Dr. George P. Cressman. Apart from a discussion of the need for accurate forecasts of the smaller-scale systems, the need for more precise and detailed forecasts of the behavior of some larger-scale meteorological features should have been stressed. Stagnating anticyclones, large pressure systems which often extend over half or more of the 48 states, may also constitute serious threats to the health and welfare of the population. The Donora episode of October 1948, the New York episodes of 1953, 1962, 1963 and 1966, the London episodes, and the Meuse valley episode are listed as examples. Such episodes can be prevented or ameliorated by limiting emissions of contaminants during an atmospheric stagnation. But action is required 24 to 48 hours before its onset. The need for forecasts of such weather conditions is apparent, and they must be accurate to avoid unnecessary costs involved in the emergency emission reduction.

2117 APTIC NUMBER 20061

Slinn, W. G. N. and S. F. Shen
ANISOTROPIC BROWNIAN DIFFUSION AND PRECIPITATION SCAVENGING OF

SUBMICRON PARTICLES. J. Geophys. Res., 75(12):2267-2270, April 20, 1970. 11 refs.

An analysis of a generalized convective diffusion equation expressing among other factors the influence of nonuniformities in the host gas on the motion of Brownian particles is presented; anisotropic Brownian diffusion is examined within the context of the precipitation scavenging of submicron particles. Such nonuniformities include tensor diffusivity and 'stressphoresis'. The use of a boundary layer approximation of the new equation demonstrates that only negligible corrections are needed to Einstein's diffusion coefficient when used for below-cloud scavenging. In the case of flows with large Mach or Knudsen numbers, these new effects could be important. The Sherwood number, which represents the nondimensionalized mass transfer, can be estimated in its asymptotic form. (Author abstract modified)

2118 APTIC NUMBER 12408

Susko, Michael, John W. Kaufman, and Kelly Hill
RISE RATE AND GROWTH OF STATIC TEST VEHICLE ENGINE EXHAUST CLOUDS. In: Aero-Astrodynamics Research Review No. 7. George C. Marshall Space Flight Center, Huntsville, Ala., Aero-Astrodynamics Lab., NASA-TM X-53782, p. 146-168, Oct. 15, 1968. 5 refs. (William D. Murphree, ed.)
CFSTI: N69-15868

In an investigation of the physical processes that occur when buoyant gases are released into the lower atmosphere, data were obtained from 20 static firings of space vehicle engines to determine height and rate of cloud rise, horizontal cloud growth at top of plume, and the height at which the cloud becomes stable. Time-sequential photography was used, and the meteorological conditions for each of the 20 tests were analyzed. Detailed results of these analyses are given; important relationships exist between the synoptic-scale weather patterns and locally measured wind, temperature, and humidity profiles, all of which influence the measured values for rise rate and growth of exhaust clouds. The data compared with previous theoretical findings, and are applicable to actual spacecraft launches as well as to static firings; they would be of particular value when toxic propellants or other potentially hazardous atmospheric pollutants are on board.

2119 APTIC NUMBER 20181

Tatarskiy, V. I.
EVALUATION OF LIGHT DEPOLARIZATION BY TURBULENT INHOMOGENITIES OF THE ATMOSPHERE. Izv. Vysshikh Uchebn. Zavedenii. Radiofiz., 10(12):1762-1765, 1967. 2 refs. Translated from Russian. Foreign Technology Div., Wright-Patterson AFB, Ohio, Translation Div., 6p., Jan. 31, 1969.
CFSTI, DDC: AD 695011

In a recent paper by D. L. Fried and G. E. Mevers, experimental data are given on depolarization of laser radiation in the atmosphere. The latter effect is interpreted as the result of the action of turbulence. Calculation of the light depolarization caused by turbulence, however, shows that the polarization observed in the experiment cannot be caused by turbulence. It is rather the presence of small amounts of aerosols in the atmosphere which may produce depolarization to a measurable extent. These aerosols do not appreciably affect the fluctuation and the average value of the field.

2120 APTIC NUMBER 18148

Tilson, Seymour
ELECTRICITY AND WEATHER MODIFICATION. III. POLLUTION PROBLEMS AND SOCIAL IMPACT. IEEE (Inst. Elec. Electron. Engrs.) Spectrum, 6(6):52-61, June 1969. 11 refs.

The five-year experiment in seeding summer clouds with silver iodide is discussed. The project failed in its attempt to increase rainfall. Total precipitation decreased 21%. The rationale of cloud seeding and the techniques of cloud seeding are discussed. Air pollution increases the concentration of condensation nuclei present in the atmosphere by as much as 1000 times. This can be expected to have significant effects on the number and size distribution of droplets in the clouds. Increased concentrations of nuclei may lead to increased cloudiness and, may exert a large inhibiting effect on the initiation of rainfall. Cloud cover may aid in reducing atmospheric interaction of pollutants, and may also serve as a cleaning agent in the lower atmosphere. Studies of cloud seeding with silver iodide and the subsequent reaction of the silver iodide with the particles of lead in the atmosphere from engine combustion and industrial plants were discussed. The two compounds react to form lead iodide which causes an increase of ice in the clouds. This might curtail rainfall. It is believed that cloud seeding with silver iodide will not work in industrial areas, but that electrical fields will increase rainfall in these areas. Electrical fields will also clear the air of excessive nuclei-pollutants. The social attitudes towards precipitation modification are discussed.

2121 APTIC NUMBER 20829

Weber, Erich
CONTRIBUTION TO THE RESIDENCE TIME OF SULFUR DIOXIDE IN A POLLUTED ATMOSPHERE. J. Geophys. Res., 75(15):2909-2914, May 20, 1970. 6 refs.

Estimation of the residence time of sulfur dioxide for polluted areas is of importance for calculating the dispersion of stack effluents. From airborn measurements in the plume of a power station, the original SO2 concentration was found to decrease 50% in 20 min to 3 hr, depending on meteorogical conditions. Similar results were obtained from measurements of ground-level ratios of CO2 to SO2 in Frankfurt am Main, where concentration of air pollutants, wind direction and speed, air temperature, and relative humidity have been continuously recorded for several years. Carbon dioxide is almost inert, while the proportion of SO2 can decrease by oxidation or absorption during transport through the atmosphere. In comparison with emissions, the air quality measurements in Frankfurt showed an increase ratio of CO2 to SO2. At a wind speed of 2m/ sec at 5 km to power plants or 2 to 3 km to the space heating chimneys, this represents a loss of about 50% SO2 in 20 min to 1 hr.

2122 APTIC NUMBER 20791

Windom, Herbert L.
CONTRIBUTION OF ATMOSPHERICALLY TRANSPORTED TRACE METALS TO SOUTH PACIFIC SEDIMENTS. Geochim. Cosmochim. Acta., 34(4):509-514, April 1970. 10 refs.

Accumulation rates of the trace metals Mn, Cu, Ni, Cr, Co, and Sr, calculated for Australian dust samples, indicate that sediment in areas of the South Pacific affected by dust falls from this source can accumulate these metals at rates similar to sediment in areas of the South Pacific where little detrital material is received. The majority of the dust was concentrated in sizes less than 15 micron. A general trend toward greater concentrations in the less than 2 micron fraction existed for copper, nickel, chromium, and possibly cobalt, suggesting that these elements are associated with the amorphous iron phases. Manganese, however, showed a greater association with the 2-5 micron size fractions. In order to determine the significance of this dust to the trace metal content of marine sediments in the South Pacific, analyses were made on cores taken from two general locations. The trace metal composition of the sediments in the Northern South Pacific reflected the high concentration of volcanic material. Both iron and manganese were considerably higher in northern South Pacific sediments than those of the western South Pacific. Copper, nickel, and cobalt also followed this trend while chromium appeased to be concentrated approximately the same way in both the same way in both the western and northern South Pacific samples. Manganese, copper, nickel, and cobalt assumulate at a faster rate with the sediments than they do with the dust. However, iron, chromium, and strontium accumulate at a faster rate in the dust then they do in the sediment. Even in the case of copper, nickel, and cobalt, the accumulation rates are not greatly different, indicating that areas affected by the dust fallout can accumulate these trace metals at rates comparable to that of marine sediments which contain little continental detrital material.

2123 APTIC NUMBER 20163

Yeliseyev, V. S.
DETERMINATION OF ATMOSPHERIC DIFFUSION PARAMETERS FROM VISIBLE CHARACTERISTICS OF A SMOKE CLOUD. (Opredeleniye parametrov atmosfernoy diffuzii po vidimym ochertaniyam dymovogo oblaka). Text in Russian. Tr. Gl. Geofiz. Observ. (Leningrad), no. 185:77-82, 1966. 7 refs.

Helicopter observation of smoke plumes at distances up to 15 km and more from the source has proven to be a sensitive indicator, both qualitatively and quantitatively, of atmospheric diffusion. Observation flight patterns and theoretical interpretation of observations are reviewed. Though these conclusions are based on observations made in 1962-1963 in the Shchekinsk Region and at the State Regional Power Station in Cherepetsk, no data are given.

2124 APTIC NUMBER 20155

Zilitinkevich, S. S., D. ... Laykhtman, and A. S. Monin
DYNAMICS OF THE BOUNDARY LAYER OF THE ATMOSPHERE. Izv. Akad. Nauk SSSR, Fiz. Atmosfery i Okeana, 3(3):297-333, 1967. 142 refs. Translated from Russian. 66p.

Modern developments in research on a planetary boundary layer are reviewed and fundamental theoretical models analyzed. The similarity theory of the boundary layer is discussed. Experimental results concerning vertical profiles of wind components, temperature, turbulent exchange coefficients, dissipation rate of turbulent energy, and other parameters are summarized. A priori models of the coefficients of viscosity are developed. (Author abstract modified)

2125 APTIC NUMBER 20069

Zorzi, Guido De
APPLICATION OF DIFFUSION EQUATIONS TO THE STUDY OF THE LOWER ATMOSPHERE. (Applicazione della equazione di diffusione allo studio della bassa atmosfera). Text in Italian. Riv. Meteorol. Aeronaut., 30(1):3-28, March 1970. 11 refs.

Properties of the lower troposphere, such as temperature and dew-point temperature, were studied with a view to predicting their development during a given time t and along a vertical line z, using a simple mathematical model which includes a unidemensional diffusion equation in which t and z are variables. The main problems presented are the analytical formula and the interval of possible numerical values for the coefficient of diffusion or the exchange coefficient. The latter coefficient governs the speed of the diffusion process, i.e., the speed of variation (in time and at various levels) of those quantitiees that characterize the physical state of the troposphere. Within the context of a given analytical form, two suitable parameters are varied, their numerical values determined by the exchange coefficient, and the results checked against actual meteorological situations. The development of the main properties of the atmosphere up to a height of 1 km above ground level lend themselves to this type of description, provided the advective motions of the air are negligible. Practical applications include a study of the formation and dissipation of temperature inversions as a result or the cooling or heating of the ground over a 24-hour period, and this is illustrated from actual cases studied in the valley of the Po. By the introduction of additional terms into the diffusion equation, it is possible to apply this type of model to predictions of cloud formations and air layers in the lower atmosphere.

# BASIC SCIENCE AND TECHNOLOGY

2126 APTIC NUMBER 17917

Asinger, Friedrich
PRODUCTION OF ORGANIC SULFUR COMPOUNDS. (Gewinnung organischer Schwefelverbindungen). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt, Germany) W. German Pat. 711,821. 3p., Jan. 29, 1939. (Appl. date not given, 2 claims).

A method for producing organic sulfur compounds was devised which is characterized by adding hydrogen-rich hydrocarbons to the mixture of compounds containing oxygen, sulfur, and a halogen. These mixtures are obtained in the familiar way by reacting SO2 and the halogen with saturated, preferably paraffinic hydrocarbons with high boiling points. The layers which form upon addition of the hydrogen-rich hydrocarbons can be easily separated. Selection of the type of hydrogen-rich hydrocarbons depends on the components of the product used. Three practical examples are given. For 500 parts of chlorine, oxygen, and sulfur containing product, 800 parts of hydrogen-rich hydrocarbons are needed. Usually the same mixture of hydrocarbons is used from which the chlorine, oxygen, and sulfur containing product has been obtained. This method of separation yields substances with different capillary action.

2127 APTIC NUMBER 20235

Asinger, Friedrich
PRODUCTION OF ORGANIC SULFUR COMPOUNDS. (Gewinnung organischer Schwefelverbindungen). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt, Germany) W. German Pat. 725,800. 2p., Jan. 31, 1939. (2 claims).

A method is presented for producing organic sulfur compounds from products which are obtained by the reacting sulfur dioxide and a halogen on saturated paraffinic hydrocarbons with a higher boiling point. The products, mixtures of compounds containing oxygen, sulfur and a halogen, are mixed with hydrogen-rich hydrocarbons, and the layers forming thereby are separated. These mixtures can also be separated by adding low-boiling oxygen containing organic compounds which can at least to some extent be mixed with alcohols (methyl, ethyl, propyl, and butyl alcohol), aldehydes, or ketones. They can be added alone or as mixtures of these substances. Products with different capillary action are obtained. For example, 500 parts of a chlorine (19%), sulfur (13.6%), and oxygen were mixed with 800 parts methyl alcohol and 50 parts water. Upon saponification with 5% sodium lye, the lower layer yielded a product with a wetting effect of 1.3 g per liter (wetting effect is expressed in grams wetting agent per liter water which are necessary to sink a round cotton piece of 3 cm diameter into the solution in 120 seconds) while the upper layer yielded a product with a wetting effect of 3.3.

2128 APTIC NUMBER 20841

Bader, Henri
THE HYPERBOLIC DISTRIBUTION OF PARTICLE SIZES. J. Geophys. Res., 75(15):2822-2830, May 20, 1970. 4 refs.

Many natural collections of small particles such as cosmic and terrestrial dust, mineral and organic particles suspended in sea water, and fine sediments, have a size distribution well formulated by the equation N equals Kx to the minus c power, where N is a number of particles larger than size x, and K and c are constants. A number of equations are derived for calculating the interesting parameters characterizing hyperbolic distribution, which are illustrated by measurements of dust and sea water obtained on a new type of particle counter. An appendix lists useful equations, generalized for different particle sizes. (Author abstract modified)

2129 APTIC NUMBER 20207

Badger, G. M.
MODE OF FORMATION OF CARCINOGENS IN HUMAN ENVIRONMENT. Nat. Cancer Inst. Monograph, no. 9:1-16, 1962. 27 refs. (Presented at the Symposium on the Analysis of Carcinogenic Air Pollution, Cincinnati Ohio, Aug. 29-31, 1961.)

Acetylene, butadiene, vinylcyclohexene, styrene, ethylbenzene, butylbenzene, phenylbutadiene, tetrahydronaphthalene, benzene, toluene, propylbenzene, and indene were pyrolyzed at 700 C, and their productes analyzed for carcinogenic compounds such as benzopyrene in order to determine which of these compounds constitute intermediate products in the formation of carcinogens at high temperature from aliphatic and similar aromatic hydrocarbons. Distillation, gas-liquid chromatography, chromatography (on alumina and on acetylated cellulose), and spectroscopy (infrared, ultraviolet, fluorescence) were used for the determinations; 50 different products were identified qualitatively and quantitatively. The quantitative yields pointed to some hypothetical mechanisms by which the carcinogens are formed, some of which were then confirmed by a radiochemical analysis of the products obtained from pyrolysis of (alpha-C14)ethylbenzene. Pyrolysis of acetylene gave 28% benzene and 2.7% biphenyl at 700 deg, but at 530 deg no biphenyl was produced. Pyrolysis of styrene produced a tar containing 3.3% toluene. Carbon-hydrogen and carbon-carbon fission yielded 'primary' radicals and these variously recombined to give less hydrogenated, more condensed products.

2130 APTIC NUMBER 17845

METHOD FOR PREPARATION OF THE TRIMETHYLAMINE-SULFUR TRIOXIDE COMPLEX. (Werkwijze ter bereiding van het complex van trimethylamine en zwaveltrioxyde). Text in Dutch. (Baldwin-Montrose Chemical Co., Maplewood, N. J.) Netherlands Pat. 6,506,804. 4p., Nov. 29, 1966. (Appl. May 28, 1965, 6 claims).

A trimethylamine-sulfur trioxide complex, suitable for the manufacture of cyclohexylsulfamic acid, is prepared by bringing the reaction components together in the gaseous phase, in the presence of an inert gas (preferably carbon dioxide) used as a dilution agent. The gas is present in sufficient quantities so that when the reaction temperature is 33 C or lower, the sulfur trioxide will condense, and in more than sufficient quantities

to insure that the SO3 will not condense at temperatures above 33 C. At temperatures above 33 deg, the molecular ratio of the inert dilution agent to the sulfur trioxide is more than 1:1. At least a portion of the sulfur trioxide is mixed with the dilution agent, and afterward the diluted sulfur trioxide is mixed with the trimethylamine. The dilution agent is introduced in liquid form to the gaseous reaction mixture of sulfur trioxide, trimethylamine, and at least a portion of the dilution agent in the gaseous state, so that its evaporation may act as a means of cooling the mixture, thus neutralizing some of the heat produced by this highly exothermic reaction. It is desirable to keep the reaction temperature below 40 C at all times.

2131 APTIC NUMBER 18193

Barnes, Edward
THE ACTION OF NITRIC OXIDE ON ALKALINE HYDROXIDES. J. Chem. Soc., p. 2605-2620, 1931.

The action of nitric oxide on the hydroxides of alkali metals and alkaline earths was chemically investigated by heating the hydroxides, at temperatures from 100 to 500 deg., in a silver boat sealed in a hard-glass evacuated tube and introducing a known quantity of nitric oxide. The residual gaseous mixtures were analyzed for nitric oxide, nitrous oxide, and nitrogen. In an experiment carried out with fused potassium hydroxide, two primary reactions occurred, one of which gave rise to nitrous oxide and the other to nitrogen. The nitrogen that formed in the reaction was considered a secondary product of the decomposition of nitrous oxide. In experiments with fused sodium hydroxide, the observed variation in the percentages of nitrogen and nitrous oxide were also attributed to the secondary reaction in which nitrous oxide decomposed. Decomposition was less rapid than for potassium. Caesium hydroxide reacted more rapidly than any of its congeners with nitric oxide while lithium reacted extremely slowly. At room temperature nitric oxide reacted very slowly with barium hydroxide. It is believed that production of nitrous from nitric oxide, as suggested by Briner and Wroczynski and Briner and Boubnoff, is due to the effect of pressure on nitric oxide.

2132 APTIC NUMBER 20245

Beck, Wolfgang, Wolf Peter Fehlhammer, Peter Poellmann, and Hans Schaechl
THE FORMATION OF ISOCYANATE COMPLEXES FROM COMPLEX METAL AZIDES AND CARBON MONOXIDE. (Bildung von Isocyanato-Komplexen aus komplexen Metallaziden und Kohlenmonoxid). Text in German. Chem. Ber., vol. 102:1976-1987, 1969. 25 refs.

The preparation, properties, and IR-spectra of L2Pd(N3)2, where L equals phosphine or amine; (C6H5)3P 2MN3, where M equals Cu(I) Ag(P), (C6H5)3PAuN3, (C6H5)3P 3MN3 where M equals Au or Rh; (C6H5)3P 4Rh2(N3)2, and of (C6H5)3P 2Ir(CO)N3 are discussed. The palladium, gold, rhodium, and iridium compounds react in chloroform or benzene solution with carbon monoxide forming the respective isocyanate complexes. The dimeric compound (C6H5)3PPd(N3)2 2 forms with CO a complex (C6H5)3PPd(NCO)2 2 which presumeably contains isocyanate bridges. Kinetic measurements were taken at the reaction L2Pd(N3)2 + CO in chloroform. There was always a great surplus of CO. The concentration change of the azido complex during the reaction was determined by measuring the intensity drop of the antisymmetric N3 molecular vibrations. Under the experimental conditions (agitation of the chloroform solution in CO atmosphere, 720 torr, 18 C), a clear dependence of the reaction speed on the type of ligande was obtained.

2133 APTIC NUMBER 17884

Beyerle, K., W. Groth, H. Ihle, A. Murrenhoff, E. Nann, and K. H. Welge
ENRICHMENT OF URANIUM ISOTOPES BY THE GAS CENTRIFUGE METHOD. (Anreicherung der Uranisotope nach dem Gaszentrifugenverfahren). Text in German. In: Proc. Symp. Isotope Separation, Amsterdam, 1957. J. Kistemaker, J. Bigeleisen, and A. D. C. Nier (eds.), New York, Interscience, 1958, Chapt. 62, p. 667-690. 17 refs.

As early as 1941, the ultra centrifuge method was used for the enrichment of uranium isotopes. The development of the gas centrifuges UZI, UZIIIA, and UZIIIB is described. The latter was developed after the war, according to the principle of the UZIIIA. The construction of the UZIIIB is described in detail. The rotor consists of a cylinder with 150 mm outer diameter, 8 mm thick walls, and a length of 700 mm. It is vacuum-tight, sealed by two lids. Since the gyro stabilization of the rotor is insufficient because of frictional forces, damped bearings were installed. The gas inlets go through the maze gaskets which are only 0.01 mm wide. A three phase induction motor with 60,000 rpm and 2.1 kilowatt mechanical power drives the rotor. By filling the centrifuge casing with hydrogen, the friction and rotor temperature were substantially reduced. Experiments with hydrogen stabilization were successful. Tests with UF6 at various pressures and throughputs showed that 75% of the theoretical separation factor could be achieved. The maximum separation of 1.15 kg UF6/year was achieved for a peripheral velocity of 280 m/sec. The power consumption was 1.5 kilowatts.

2134 APTIC NUMBER 17950

Bloembergen, N.
NONLINEAR OPTICS. (Optique non-lineaire). Text in French In: Quantum Electronics. P. Grovet and N. Bloembergen (ed.), New York, Columbia Univ. Press, 1964, p. 1501-1512. 13 refs.

The classical theory of nonlinear interaction of wave-trains of light could have been developed as long as more than 60 years ago. Ray Leigh had discussed nonlinear acoustic equations. In 1900, Maxwell's equations were applied to a number of non-linear problems, particularly in connection with ferromagnetic materials. Lorentz and Drude had shown how a model of electrons oscillating harmonically can be used to explain the optical properties of crystals. They failed to realize that the response of the electrons to electromagnetic forces could be slightly inharmonic. An applied field of frequency omega produces a polarization at harmonic frequencies. In cases when several frequencies are applied simultaneously, one obtains all linear combinations of these frequencies. Another example of nonlinearity

is Thompson's model of the response of a free electron to an electrometric wave. Maxwell's equation of wave propagation with a non-linear driving term has a solution formed by the general solution of the linear homogenous equation and the particular solution incorporating the driving term. The interference of the wave trains represented by these two solutions is associated with energy transfer due to the nonlinear interaction. In a similar manner, certain typical features of quantum-electronics problems are illustrated by the use of simple quantum systems with but two or three energy levels; their stationary solutions may be found by a semi-classical pertubation method.

2135 APTIC NUMBER 20838

Brock, J. R.
NONCONTINUUM UNIPOLAR CHARGING OF AEROSOLS: THE ROLE OF EXTERNAL ELECTRIC FIELDS. J. Appl. Phys., 41(5):1940-1944, April, 1970. 20 refs.

It is well established that external electric fields can effect considerable increases in the rates at which ions are captured by aerosol particles. Inasmuch as important industrial operations involving aerosols, such as electrostatic precipitation depend upon efficient particle charging, various investigations have been carried out seeking to clarify the role of external electric fields in the charging process. An approximate theory is presented for the charging by heavy ions of submicron particles in external electric fields. Unlike previous theories for field charging of submicron particles, this theory proceeds from a nonintuitive basis established by kinetic theory and reproduces the general features found in the relevant experimental data. A brief review of previous work relating to field charging is presented first. Then, the theory for field charging of submicron aerosol particles is developed, followed by a discussion of this theory in light of available experimental data.

2136 APTIC NUMBER 18198

Brocklehurst, B., and K. R. Jennings
REACTIONS OF NITROGEN ATOMS IN THE GAS PHASE. Reaction Kinetics, 4:1-36, 1967. 160 refs.

Much of the complexity of the reactions of N atoms can be attributed to the fact that N is trivalent. There are nine electronic states lying below the dissociation limit. All of these could be populated by the recombination of two ground-state N(4s) atoms, either directly or by a collision-induced process, and all could be present in active N. Nitrogen can form strong multiple bonds in reactions that are very exothermic and fast. The exothermicity can lead to the formation of electronically-excited species and, at low pressures, results in considerable fragmentation. Nitrogen does not form strong single bonds, so that processes in which NH might be formed are usually 0.5 to 0.8 eV endothermic and consequently will not occur at room temperature. The addition of an N atom may be the initial step in some reactions, but in many cases it appears that the reaction is initiated by electronically-excited N molecules, the N atoms reacting with the resulting radicals. New physical methods of studying reactions will assist in the determination of the mechanisms of these complicated reactions, but there is a clear need for the development of other methods of producing N atoms.

2137 APTIC NUMBER 20189

Brockmeier, Norman F.
CHEMICAL REACTIONS INDUCED IN A MICROWAVE DISCHARGE. Massachusetts Inst. of Tech., Cambridge, Dept. of Chemical Engineering, Thesis (Ph.D), 138p., Aug. 1966. 60 refs.

A suitable chemical system was determined for microwave discharge and the relationship was found between the microwave power and the chemical parameter. The chemical systems investigated included the reactions of hydrogen chloride with solid carbon or with hydrocarbon gases (methane, ethylene, or acetylene) and the oxidation of sulfur dioxide. The discharges were induced in a tubular quartz flow reactor, with energy supplied by a microwave power generator at fixed 2450 mc frequency with a continuous wave magnetron capable of 1200 watts output. The hydrogen chloride system did not achieve a reasonable conversion. However, 60% of the sulfur dioxide feed was oxidized with air at 300 C without using a catalyst. The conversion of the sulfur dioxide-oxygen feed was proportional to the concentration of various third gases, such as sulfur hexafluoride, carbon tetrafluoride, or nitrogen added to feed. The hypothesis that the termolecular collision O + SO2 + M yields SO3 + M was the rate-controlling step in the formation of sulfur trioxide was supported by experimental data. An energy balance of the reactor showed that the adsorbed microwave power was 50 times the power required to dissociate the oxygen consumed. These results applied over the entire range of conditions studied: pressure, 5 to 160 torr; power, 50 to 480 watts; and feed rate, from 90 to 300 cc/min measured at one atm and 21 C. The effectiveness of the third gas was directly proportional to its heat capacity and inversely related to the ease with which the third gas was excited by the discharge. (Author abstract modified)

2138 APTIC NUMBER 20867

Brundle, C. R.
ON THE FIRST IONIZATION POTENTIALS OF NITROGEN DIOXIDE AND NITRIC OXIDE. Chem. Phys. Letters (Amsterdam), 5(7):410-415, May 15, 1970. 23 refs.

Investigations of the first ionization potential (IP) of nitrogen dioxide by high-resolution photoelectron spectroscopy show that the lowest value that can reasonably be given for the adiabatic IP by this technique is 10.0 eV. Excitation of the bending mode, V2 with frequency 650 reciprocal cm is observed. Traces of NO (adiabatic IP 9.26 eV) can lead to misinterpretations. An explanation is offered for the discrepancy between the value reported for the IP of NO2 by a photoionization mass spectrometric technique and the present results. (Author abstract)

2139 APTIC NUMBER 20046

Bulang, W., W. Groth, I. Jordan, W. Kolbe, E. Mann, and K. H. Welge
ON THE SEPARATION POTENTIAL OF THERMALLY DRIVEN COUNTERCURRENT GAS CENTRIFUGES. II. ASYMMETRICAL SEPARATION PROCESS. Z. Physik. Chem. Neue Folge, (Frankfurt), vol. 24:249-264, 1960. 4 refs. Translated from German by Kurt H. Quasebarth, Virginia Univ., Charlottesville, Div. of Engineering Physics, 22p. Sept. 1960.

The theory of separation potential with respect to thermally driven countercurrent gas centrifuges is extended and experimental results are presented. Maximum separation potential occurs when the tapping ratio (i.e, ratio of light fraction molar flow to total molar flow) ranges from 0.3 to 0.4. In this case, enrichment of the light fraction is substantially greater than in the symmetrical case (i.e., tapping ratio of 0.5). Design improvements of the 2G5 gas centrifuge are given. The results are important for isotope separation.

2140 APTIC NUMBER 20165

Byers, B. Lee
PARTICLE DEPOSITION FROM TURBULENT STREAMS BY MEANS OF THERMAL FORCE. Pennsylvania State Univ., University Park, Dept. of Chemical Engineering, Thesis (PH.D), Ann Arbor, Mich., Univ. Microfilms, Inc. 1967, 122p. 53 refs.

The effect of thermophoresis on particle deposition from hot gases in a turbulent flow was studied with a view to estimating the possibility of the use of thermal force for cleaning large quantities of hot gases under turbulent conditions. A sodium chloride aerosol was heated to 900 F and passed through a copper tube in a water-cooled jacket. The large thermal gradient generated in the laminar sublayer by turbulent flow provided a driving force for thermal deposition. Particle collection was measured with a Goetz Aerosol Spectrometer. Collection efficiency was plotted as a function of aerosol temperature, flow rate, and length-to-diameter ratio of the corrector. Particle deposition by thermal force is most heavily influenced by particle size and aerosol temperature. Collection efficiency varies from 30% (0.3 micron particles) to 5% (1.2 micron particles). Collection efficiency varies directly with the thermal gradient, which in turn varies directly with the absolute temperature of the aerosol stream. Experimental efficiencies in the slip flow region were higher than those predicted by the present mathematical model. The results suggested that the coefficient of the Knudsen number and the exponential term by which the thermal force is related to the free molecular thermal force is not a constant, but is dependent on temperature. It was concluded that particle deposition of this type yields a low collection efficiency, despite the large thermal gradient in the laminar sublayer. Collection efficiency in the slip flow regime is approximately predictable by Brock's equation. Efficiency decreases with particle size, especially for Knudsen numbers greater than 0.2. Gas temperature is the most important of the system parameters. Efficiency is directly proportional to gas temperature and decreases slightly as velocity increases. Diffusion is not a significant factor in particle deposition. Rates of deposition can be predicted within about 30%, provided one knows the absolute terminal concentration of the aerosol and the nature of the molecule-particle interaction.

2141 APTIC NUMBER 17949

Cola, Mario and Carla Castellani Bisi
THERMAL DECOMPOSITION OF CERTAIN METALLIC SULFITES. (Decomposizione termica di alcuni solfiti metallici). Text in Italian. Gaz. Chim. Ital., vol. 91:173-186, Jan.-July 1961. 10 refs.

Experiments are presented of heating sulfites of silver, tantalum (valence 1), strontium, barium, and lead in a stream of nitrogen in order to demonstrate the role of the dismutation reaction in the formation of sulfides and sulfates. This was the principal reaction in the case of tantalum, strontium, and barium sulfites. With lead sulfite, it ran paralled with the dissociation to an oxide and sulfur dioxide; with silver sulfite, it seemed to be completely absent.

2142 APTIC NUMBER 20807

Coomber, John W. and James N. Pitts Jr.
SINGLET OXIGEN IN THE ENVIRONMENTAL SCIENCES. VIII. PRODUCTION OF O2(1 DELTA G) BY ENERGY TRANSFER FROM EXCITED BENZALDEHYDE UNDER SIMULATED ATMOSPHERIC CONDITIONS. Environ. Sci. Technol., 4(6):506-510, June 1970. 23 refs.

The production of singlet molecular oxygen via the absorption of light (lambda greater than 2900 A) by benzaldehyde and subsequent energy transfer to ground state molecular oxygen was observed under simulated atmospheric conditions. The singlet oxygen was detected by monitoring the hydroperoxide product of its reaction with 2,3-dimethyl-butene-2 by a long path length infrared spectroscopy. Other mechanisms for hydroperoxide formation in the system are discussed: direct absorption of visible radiation by ground state oxygen to give O2 (1 sigma g(+)) which is collisionally deactivated to O2(1 delta g); and absorption of ultraviolet light by an oxygen-olefin 'collision complex. This may lead directly to the hydroperoxide product or result in the perturbation and enhancement of the 'forbidden' singlet-triplet absorption of 2,3-dimethyl-butene-2 by O2 (3 sigma g(-)) followed by energy transfer to give hydroperoxide. (Author abstract modified)

2143 APTIC NUMBER 20789

Coon, J. B., F. A. Cesani, and F. P. Huberman
2491-A ABSORPTION SYSTEM OF NO2 AND A DOUBLE MINIMUM POTENTIAL. J. Chem. Phys., 52(4):1647-1654, Feb. 15, 1970. 14 refs.

The 2491-A absorption system of nitrogen dioxide(16) and the corresponding system of N(18)O2 were photographed at temperatures up to 600 C. For each molecular species, measurements yielded the ground-state frequencies v sub 1 double prime, v sub 2 double prime, 2v sub 1 double prime, and v sub 1 double prime + v sub 2 double prime as well as the excited-state frequencies v sub 1 prime, v sub 2 prime, and 2v sub 3 prime. A large isotopic shift observed for the (0-0) band was consistent with the assignment 2v sub 3 prime equals 713 reciprocal cm, even though this frequency was quite small compared to the frequency v sub 1 prime

equals 1156 reciprocal cm. Two facts which demand explanation are the isotopic shift of the frequency 2v sub 3 prime, and the relative intensity of the cold band involving 2v sub 3 prime. These facts cannot be explained in terms of harmonic potentials in the antisymmetrical coordinate Q sub 3 prime, but can be explained in terms of a double minimum potential in this coordinate. The barrier of this potential was about 722 reciprocal cm and the inversion doubling was near 103 reciprocal cm. At vibrational equilibrium, the calculated N-O bond lengths were 1.426 and 1.202 A. (Author abstract modified)

2144 APTIC NUMBER 17888

Cupr, Vaclav
ABSORPTION OF HYDROGEN CHLORIDE GAS AND SULFUR DIOXIDE IN SULFURIC ACID AND ACETIC ACID. (Ueber die Absorption von Chlorwasserstoffgas und Schwefeldioxyd in Schwefelsaeure und Essigsaeure). Text in German. Rec. Trav. Chim., vol.47:55-72, 1928. 33 refs.

The absorption isotherms in aqueous solutions of sulfuric acid at 25 C and sulfur dioxide at 20 C, have a minimum at 89 and 86% $H_2SO_4$, respectively, both of which lie close to the composition of the $H_2SO_4.H_2O$ monohydrate of sulfuric acid. To verify that the above minimum are due to the formation of the above monohydrate, extensive determinations of absorption isotherms of HCl and $SO_2$ in aqueous solutions of $H_2SO_4$ and $CH_3COOH$ were performed, as well as in pure $H_2O$. The apparatus and the procedures used are described. The amounts of HCl, or $SO_2$, absorbed were determined by argentometric as well as iodometric titration, and are given in terms of grains of HCl, or $SO_2$, per 100 grams of the $H_2SO_4$ or $CH_3COOH$, aqueous solution. The absorption isotherms of HCl gas were determined in aqueous $H_2SO_4$ at 0, -15.8 and -25 C in concentrations at which at the above temperatures the hydrates $H_2SO_4.2H_2O$ and $H_2SO_4.4H_2O$ do not precipitate; in aqueous $H_2SO_4$ with between 62 and 98% $H_2SO_4$ at 40 and 60 C; in 96% $H_2SO_4$ at six temperatures between 0 and 75 C; in aqueous $CH_3COOH$ at 0 and 25 C; and in pure $H_2O$ at 0 and 25 C. The absorption isotherms of $SO_2$ were determined in aqueous $CH_3COOH$ at 27 C; in aqueous $H_2SO_4$ at 41 and 62 C; and in pure $H_2O$ at 27, 41 and 62 C. The present results agree with those given in literature. The relationship between lowering the absorption capacity of the absorbent solution and the formation of the $H_2SO_4$ monohydrate is pointed out.

2145 APTIC NUMBER 17982

(Inventor not given.)
METHOD OF PRODUCING COMPOUNDS OF AROMATIC p-DIAMINES WITH SULFUR DIOXIDE. (Verfahren zur Dorstellung von Verbindungen aromatischer p-Diamine mit Schwefeldioxyd). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt, Germany) West German Pat. 484, 836. 1p., Oct. 10, 1929. (1 claim).

Aromatic p-diamines can be converted to water soluble, storable compounds if the bases are dissolved in an indifferent organic solvent and treated with sulfur dioxide by excluding any water. A compound of the bases with sulfur dioxide is precipitated which contains 1 mol $SO_2$ per 1 mol diamine. For example, 1 part of 1-methyl-2,5-diaminobenzene is dissolved in 4 parts benzene. Sulfur dioxide is added to saturation. A reddish-brown compound precipitates which drawn off and dried in the air until the benzene disappears. A white compound remains which is readily soluble in cold water and in cold alcohol, but less soluble in acetone and insoluble in ether, benzene, and chloroform. The $SO_2$ content after 24-hour storage in air is 35.97%.

2146 APTIC NUMBER 11873

Fatiadi, A. J. and A. Cohen
PHOTOCHEMISTRY OF AROMATIC AIR POLLUTANTS. National Bureau of Standards, Washington, D. C., TN-427, p. 17-31, Oct. 1967. 47 refs.

The photochemical changes of pyrene, perylene, and fluorene adsorbed on soil samples; of 1,4-dihydroxyanthraquinone on silica gel; of anthracene on carbon; and of a solution of naphthacene in benzene when exposed to air and ultroviolet radiation were studied. The products obtained by adsorption of pyrene on soil included 1,1-bipyrene and unreacted pyrene. The photochemical reaction of perylene adsorbed on soil produced 3,10 perylenequinone and other non-identified compounds. Fluorene adsorped on soil and irradiated yielded 1,2-to 2,2'-biphenylylene ethylene and pure fluorene-9-one. The other components were not identified. The 1,4-dihydrooxyanthraquinone did not undergo photooxidation on silica gel. Likewise, anthracene did not undergo photooxidation on carbon. Naphthacene was photooxidized to naphthacenequinone. By changing the length of time for the oxidation, the following yields were obtained: 55%, 90 min; 50%, 45 min; and 64%, 35 min. Chromatography yielded two other spots apart from naphthacenequinone at Rf 0.34 and 0.03 which have not been identified but are being studied further.

2147 APTIC NUMBER 17924

Freiherr von der Horst in Leuna, Horst Dietrich
METHOD FOR THE PRODUCTION OF SULFUR CONTAINING ORGAINC COMPOUNDS. (Verfahren zur Herstellung von Schwefelhaltigen Organischen Verbindungen). Text in German (Farbenindustrie (I. G.) A. G., Frankfurt, Germany) W. German Pat. 719,059. 3p., Jan. 19, 1939. (1 claim).

Organic sulfur compounds can be obtained if oxygen, sulfur, and halogen containing products with at least one carbon atom not bound to a halogen are converted in the presence of ammonia or amines with phenols. The products are obtained in the familiar manner by reacting a halogen and sulfur dioxide (if necessary under the influence of short-wave light) with aliphatic hydrocarbons. Gaseous ammonia is added to the point of saturation to this mixture. The mixture can also be passed through a packed tower countercurrent to the ammonia flow. The temperature at the reaction should not exceed 30 to 40 C. Methyl amine, dimethyl amine, or ethyl amine can be used instead of the ammonia. The ammonium halide which forms can be separated by filtration or centrifugation. For better filtration, 0.5 to 5% water can be added. The products obtained by this method can be used as softeners for polymerides. Four practical examples are given.

2148 APTIC NUMBER 20788

Gay, Ian D.
CATALYTIC DECOMPOSITION OF N2O AND OXYGEN DESORPTION SPECTRA ON NIO. J. Catalysis, 17(2):245-251, May 1970. 9 refs.

Desorption spectra were obtained for oxygen desorbing from NiO after adsorption of O2 and after catalytic decomposition of N2O. Three different binding states can be produced by adsorption of O2 under various conditions, and a fourth during decomposition of N2O. An attempt is made to relate the kinetics of N2O decomposition to the nature of the binding of adsorbed oxygen. (Author abstract)

2149 APTIC NUMBER 20792

Georgii, Hans-Walter and Dieter Woetzel
ON THE RELATION BETWEEN DROP SIZE AND CONCENTRATION OF TRACE ELEMENTS IN RAINWP R. J. Geophys. Res., 75(9): 1727-1731, March 20, 1970. 7 refs.

Rainfall was separated according to drop-size spectrum with a drop-size discriminator of the authors' design. Twenty individual cases of rainfall were anlayzed. The rainfall rate varies between 2 and 15 mm. Three fractions of precipitation water were collected, consisting of drops with an average diamter of 1.5, 1.0, and 0.75 mm. Some overlapping of drop size could not be avoided. Chemical analysis of the different size fractions showed that small drops contain a higher concentration of impurities than large drops from the same rainfall. This result is valid for all components analyzed. The results can be explained on the basis of trace substances and particial drop evaporation below the cloud base. (Author abstract modified)

2150 APTIC NUMBER 18159

Gloyna, Earnest F., and Ernesto Espino
SULFIDE PRODUCTION IN WASTE STABILIZATION PONDS. J. Sanit. Eng., Div. Am. Soc. Civil Engrs., 95(SA 3):607-628, June 1969. 17 refs.

The production and release of hydrogen sulfide in a model facultative pond was investigated under seven different operating conditions. Operating characteristics of the tests were designed for developing empirical relations between sulfide concentrations and the following parameters: BOD leads detention time, sulfate concentration in the influent, and sulfate surface load. The diffusion rate of hydrogen sulfide from the pond was determined in a complementary set of experiments. Results show that the average sulfide concentration in a stabilization pond can be estimated by the equation (S--) equals K x (SO4--) in which (SO4--) equals the concentration of sulfate in the influent, and the dimensionless constant, K, equals a function of the operating characteristics and the average temperature of the pond. Coefficients were determined for an average pond temperature of 25 C, and two empirical equations were developed to estimate sulfide concentration in a pond. Oxidation of sulfide by photosynthetic oxygen was found to reduce sulfide concentration 5-20% during the day. Increases in sulfide concentrations from near zero to near one and two mg/l reduced the oxidation-reduction potential (ORP) 80 mv and 120 mv, respectively. Further increases in sulfide concentration reduced the ORP in lesser amounts. The rate of transfer of hydrogen sulfide was expressed by Fick's equation with a diffusion constant value of 0.006 mph at 22 C.

2151 APTIC NUMBER 18172

Greiner, Max
CONTRIBUTION TO THE DETERMINATION OF THE DEGREE OF FUEL UTILIZATION IN INTERNAL COMBUSTION ENGINES BY CONTINUOUSLY MONITORING THE EXHAUST GAS. (Beitrag zur Fanggradbestimmung an Verbrennungsmotoren durch kontinuierliche Abgasanalyse.) Text in German. VDI (Ver. Deut. Ingr.) Z. (Duesseldorf), 110(34):1527, Dec. 1968.

In order to determine the amount of air/fuel mixture which passes through an internal combustion engine without participating in the combustion process, a gas must be found which is completely consumed by the combustion in the cylinders but does not react with the hot waste gas. In Otto-engines, oxygen was found to be a suitable test gas when used with fuel mixtures with a deficiency of air. The stability in the exhaust system was tested. Butane is useful for Diesel engines. It is stable up to 450 C and therefore does not react with the exhaust gas. Measuring the butane concentration at the air intake and in the exhaust system yields the fraction of unused fuel/air mixture.

2152 APTIC NUMBER 20843

Gross, Paul, Robert T. P. deTreville, and Martin N. Haller
ASBESTOS VERSUS NONASBESTOS FIBERS. Arch. Environ. Health, 20(5):571-576, May 1970. 12 refs.

The inhalation of air polluted with asbestos dust may be responsible for asbestotic pulmonary fibrosis, increased prevalence of lung cancer, and mesothelioma. A number of fibrous dusts other than asbestos can produce ferruginous bodies in the lungs, so the presence of these bodies is not necessarily an index of asbestos pollution. To determine the extent of exposure to asbestos dust, it is necessary to indentify the naked fibers and central cores of ferruginous bodies isolated from lungs of urban dwellers. The fractured end of asbestos fiber is irregular with step-like projections, while fibers other than asbestos present smooth profiles. Another important difference is the longitudinal, parallel delineation of individual fibrils of asbestos when viewed at a magnification of twenty thousand times. The view of a nonasbestos, fiber is devoid of such longitudinal lines. Fibers with diameters from two micron down to one tenth of one micron were successfully identified. Asbestos fibers come from industrial products such as chrysotile and amosite, as well as from cosmetic and dusting powders. The method presented is less time-consuming and more economical than the electron diffraction and electron microprobe analysis techniques.

2153 APTIC NUMBER 20023

Hamill, William H.
EQUILIBRIA IN SOLUTIONS. Proc. Indiana Acad. Sci, vol. 51:165-166, 1942. 8 refs.

The solubility of sulfur dioxide in acetone and in methyl acetate conforms neither to Raoult's law nor to Henry's law. However, by treating each system as though a one-to-one compound exists and as though the formation of this compound were entirely responsible for the observed deviations, the solubility of sulfur dioxide in both cases can be brought into conformity with Raoult's law. The equilibrium constants computed by the method are tabulated.

2154 APTIC NUMBER 18146

Hart, F. X. and Ch. H. Bachman
THE EFFECT OF AIR IONS ON LIQUID EVAPORATION RATES. Intern. J. Biometeorol. (Leiden), 12(3):251-261, July 1968. 10 refs.

The effect of small air ions on liquid evaporation is discussed. In this study the evaporation rates of water, heptane, ethyl alcohol, and physiological saline were investigated as a function of atmospheric ion density. Evaporation rates decreased with increasing ion density to a minimum after which evaporation increased steadily. For water a reduction of 15% occurred. The different liquids exhibited some deviations from this general pattern. The effects are specific to the type of gas ions, and are also associated with the polar nature of the liquid molecules. It was found that polar molecules evaporate more quickly than nonpolar in the presence of gas ions. The modification of evaporation may be a mechanism by which biological effects are produced by air ions.

2155 APTIC NUMBER 18183

Hasche, R. Leonard, and Walter A. Patrick
STUDIES ON THE RATE OF OXIDATION OF NITRIC OXIDE. II. THE VELOCITY OF THE REACTION BETWEEN NITRIC OXIDE AND OXYGEN AT 0 AND 30 DEGREES. J. Am. Chem. Soc., 47:1207-1215, May 1925. 14 refs.

The reaction between NO and O2 was third order at 30 deg, while the acceleration in the velocity constants at 0 deg may be due to the formation of N2O3 or to the imperfect state of N2O4. A large increase in surface-to-volume ratio, accomplished by the introduction of glass wool into the reaction chamber, caused a marked acceleration in the velocity constants in the latter half of the reaction at 30 deg. The acceleration was less pronounced at the lower temperature. No evidence of autocatalysis was obtained. The negative temperature coefficient noted for the reaction is attributed to the formation of intermediate compounds.

2156 APTIC NUMBER 17817

Hedin, Rune
INVESTIGATIONS OF THE LIME BURNING PROCESSES. Svenska Forskningsinst. Cement Betong Vid Kgl. Tek. Hogskol. Stockholm, Handl., no. 32, 123p., 1961. 82 refs.

Crystals of Icelandspar in the form of cleavage rhombohedrons with an edge length of about 2 mm were dissociated in a furnace while enclosed in an autoclave. The external length, degree of dissociation, and the structure of the oxide surface seen by electron microscopy were determined over a temperature range 690 to 1220 C, a furnace pressure range of 2 mm Hg to equilibrium, and for varying time periods. The effects of post-heating to a higher temperature on external volume and surface structure were also investigated. Below 1070 C, the dissociation kinetics are mainly determined by the coupling of heat transport with a chemical process, which comprises the nucleation step. The structure of the oxide depends on the temperature and on the velocity of decomposition, according to current nucleation theories. Sintering was believed to increase with temperature and decomposition velocity also. Above 1070 C, sintering influences the reaction velocity via gas flow resistance, and the reaction velocity influences sintering via the nucleation process, thus giving rise to a complicated increase-decrease behavior in the reaction velocity and the shrinkage. Above 1180 C, the effect of sintering on the decomposition velocity becomes less important, probably because of the high internal pressure. (Author summary modified)

2157 APTIC NUMBER 17925

Herold, Paul, Karl Smeykal, Friedrich Asinger, and Horst Dietrich Freiherr von der Horst in Leuna
METHOD FOR THE PRODUCTION OF ORGANIC SULFUR COMPOUNDS. (Herstellung von organischen Schwefelverbindungen). Text in German. (Farbenindustrie (I. G.) A. G., Frankfurt, Germany). W. German Pat. 715,846. 3p., June 10, 1938. (1 claim).

New types of organic sulfur compounds can be obtained by conversion of sulfur, oxygen, and halogen containing products with alcohols or phenols. The sulfur, oxygen, and halogen containing product is obtained in the familiar manner by reacting a halogen and SO2 with saturated aliphatic hydrocarbons in the liquid phase. The hydrocarbons are solved in a liquid, molten or inert solvent. The temperature at the process is normal or somewhat increased. The following alcohols can be used: aliphatic alcohols, such as methyl alcohol; its primary, secondary and tertiary homologues; glycols; cycloaliphatic alcohols, such as cyclohexanol, mixed with aliphatic-aromatic alcohols, such as benzylalcohol or phenylethyl alcohol; and single or multi-valent phenols, such as phenol and its homologues, naphtholes and resorcine. The new organic compounds obtained this way can be used as solvents and softening agents for polyvinyl compounds, cellulose derivatives, etc. The alcohols or phenols are solved in aqueous sodium lye. Four practical examples are given.

2158 APTIC NUMBER 20195

Hochrainer, Dieter
AEROSOL DEPOSITION ON A SINGLE FIBER UNDER THE INFLUENCE OF ELECTRICAL FORCES. PART II. EXPERIMENTS FOR RENDERING PARTICLE TRAJECTORIES VISIBLE. Staub (English translation from German

of: Staub, Reinhaultung Luft), 29(2):28-32, Feb. 1969. 5 refs.

An experimental apparatus was constructed to verify theoretical predictions concerning trajectories of aerosol particles and their deposition on fibers in electrical fields. The particles are observed by means of microcinematography from which the trajectories are obtained. Tests were performed on an enlarged scale. A cyclinder 1 mm in diameter was used to represent the fiber, while the aerosol particles measured 1.8 micron. Semiquantitative analysis of the results showed that all patterns of particle trajectory predicted by theory can be materialized, including the stationary trajectories around the singular points.

2159 APTIC NUMBER 17846

Hoffmann, Arthur Kentaro
NEW SOLVENT-ELECTROLYTE SYSTEMS FOR ELECTROCHEMICAL CELLS. (Nouveaux systems solvent-electrolytes pour cellules electrochimiques). Text in French. (American Cyanamid Co., Wayne, New Jersey) Belgian Pat. 670,775. 28p., April 12, 1966. 3 refs. (Appl. Oct. 11, 1965, 8 claims).

The invention, which incorporates the claims of U. S. Patent 403,659 of October 13, 1964, and U. S. Patent 247,973 of January 25, 1965, concerns a solvent-electrolyte system for use in secondary electrochemical cells, where the product desired is a lightweight, high-energy cell using an alkali metal. The system is a mixture of sulfur dioxide, an electrolyte salt appreciably soluble in the mixture and chemically inert, for all practical purposes, in the presence of sulfur dioxide and an organic solvent that does not yield acidic hydrogen ions and that contains an element possessing at least one pair of unshared electrons, in relative proportions sufficient to contribute a fair degree of mutual solubility and a specific conductivity of at least 5 times 5 to the minus 5th reciprocal ohms per centimeter at 22 C. The preferred electrolyte salts are lithium perchlorate and lithium chloride. The organic solvent can be acetonitrile or propylene carbonate. The system can be used in a reversible cell (rechargeable battery) consisting of a nickel anode and a silver-silver chloride cathode.

2160 APTIC NUMBER 17944

Janatjewa, O. K. and W. T. Orlowa
THE EQUILIBRIA IN THE QUINARY RECIPROCAL SYSTEM K, NA, MG/CL, SO4 - H2O AT 100 C. (Ueber die Gleichgewichte im quinaeren reziproken System K, Na Mg/Cl, SO4 - H2O bei 100 C). Text in German. Freiberger Forschungsh. A., 1961:377-382, 1961. 10 refs.

A complete equilibrium diagram of the quinary system was obtained in a study of the interactions of the chlorides and sulfates of potassium, sodium and magnesium in an aqueous medium at 100 C which contained 12 crystallization volumina of the phases. the major part of the studied diagram was taken by the water-free potassium compounds K2SO4.2MgSO4, 3K2SO4.Na2SO4; the salting out effect of the chlorides in the system became most obvious with respect to the potassium-magnesium salt Langbeinit. Together with previously obtained data, the results permit the establishment of a solubility polytherm for the system K, Na, Mg/Cl, SO4-H2O from 0 to 100 C.

2161 APTIC NUMBER 20012

Janiczek, Witold
VERIFICATION OF KINETICS OF NITRIC OXIDE OXIDATION WITH SIMULTANEOUS ALKALINE ABSORPTION UNDER CONDITIONS OF TECHNOLOGICAL PROCESS. (Sprawdzenie kinetyki utleniania tlenku azotu przy rownoczesnie przebiegajacej absorpcji alkalicznej w warunkach technicznych). Text in Polish. Przemysl Chem., vol. 37:448-450, 1958. 3 refs.

The rate equations for the oxidation of nitric oxide to nitrogen dioxide under conditions of alkaline absorption were derived. Different models considered included alkaline absorption at constant volume, absorption in hydroxide at constant pressure, absorption in Na2CO3 at constant pressure, simplified alkaline absorption, and usual oxidation at constant volume. The time necessary to achieve a certain degree of oxidation was calculated and values for different models compared. The differences between individual modifications of alkaline absorption were negligible. The differences in times of achievement of certain degree of oxidation between alkaline absorption and usual oxidation were more pronounced only in later stages of the process; NO concentration diminishes more rapidly due to simultaneous absorption NO with NO2 in alkaline media. The models derived were experimentally tested in the production of NaNO2, where the gases resulting from NH3 combustion were lead through Na2CO3 solution in absorption columns. The experimental results fall in between the data for alkaline absorption at constant volume and absorption in Na2CO3 at constant pressure. The oxidation of NO was the process limiting the rate of absorption of nitric gases after NH3 combustion, which is even more pronounced in the case of more diluted effluent gases. The concentration and alkalinity of the absorbing agent had little effect on the whole process.

2162 APTIC NUMBER 20856

Jones, Llewellyn H.
POTENTIAL CONSTANTS OF NITROUS OXIDE. J. Mol. Spectr., vol. 34:108-112, 1970. 12 refs.

Least squares estimates of compliance constants, force constants, and interaction coordinates were calculated for nitrous oxide from recent literature values of vibrational frequencies and centrifugal distortion constants of isotopic species. Mean square amplitudes and Coriolis coupling constants were also calculated. Observed amplitudes have not been reported, however, the observed Coriolis values for N14N14O16 are in reasonable agreement with the calculated values. For mean squares amplitudes to be useful in least square calculations of the potential constants, they would have to be known to within a few percent, which is not likely with present-day electron diffraction techniques. The interaction coordinates indicate that if the NO bond length is constrained in a configuration longer than its equilibrium length, the resulting electron rearrangement would lead to a shortening of the NN bond, for minimum energy, equal to 6% of the NO displacement. The average of (NN)NO and (NO)NN is

equal to the interaction coordinate of CO2 in accord with the similarity in bonding. (Author abstract modified)

2163 APTIC NUMBER 18185

Jordan, C. W., A. L. Ward, and W. H. Fulweiler
GUM DEPOSITS IN GAS DISTRIBUTION SYSTEMS. Ind. Eng. Chem., 27(10):1180-1190, Oct. 1935. 31 refs.

The efficacy of iron sulfide for the absorption of nitric oxide, together with conditions favoring its use, was determined by a series of experiments involving the absorption of undiluted and dilute nitric oxide by iron sulfide, and alkaline and metallic sulfite absorbents. The highest activity for the absorption was obtained by sulfided Lux iron oxide to which sufficient sodium bicarbonate had been added to give an alkali ratio of 50%. Iron sulfide is economically feasible as an agent for the commercial purification of manufactured gases because it can be made from the hydrogen sulfide already present in commerical gas, and it is not poisoned by sulfur of cyanogen compounds, reduced by hydrogen, or affected by carbon dioxide or carbon monoxide. Though it does react with the small amount of oxygen present in manufactured gas, iron sulfide can be used to advantage in removing hydrogen sulfide from gas. As a result of the laboratory experiments, an inexpensive, commercial process was developed for removing all of the nitric oxide.

2164 APTIC NUMBER 20052

Karzhavin, V. A. and A. V. Abdeyeva
THE REACTION OF PYRITE WITH WATER VAPOR AND SULFUR DIOXIDE. (Vzaimodeystviye kolchedana s vodyanym parom i sernistym gazom). Text in Russian. Khim. Prom. (Moscow), no. 12:25-29, 1934. 18 refs.

Due to reversibility of the decomposition of iron sulfide by water vapor at temperatures up to 1000 C, it is necessary to use a great excess of steam. In this case, sulfur is derived mainly in the form of hydrogen sulfide with small quantities of sulfur dioxide and sulfur. The iron converts to ferrosoferric oxide. Reaction of iron sulfide with SO2 yields sulfur in elemental form and the iron goes to Fe3O4. When iron sulfide is acted on by both steam and SO2, the water reacts more readily and at lower temperatures then in the absence of SO2.

2165 APTIC NUMBER 20179

Khorguani, V. G.
ON THE NATURE OF MOTION OF INDIVIDUAL COARSE OR FINE PARTICLES WITH A SYSTEM OF PARTICLES. (O kharaktere dvizheniya otdel'nykh krupnykh ili melkikh chastits s sistemoy chastits). Text in Russian. Tr. Nalchik. Vysoko. Geofiz. Inst., no. 6:5-8, 1968. 1 ref.

The motion of aerosol particles of mixed size was studied; the velocity of particle motion was taken as the basic characteristic. A more coarse particle (3.15-mm diameter) falls 2-2.5 times faster with a system of fine particles (2.00-mm diameter) than it does alone; the velocity difference increases as interparticle distance decreases. In such a system, the fall rate of coarse particles is greater, the greater the fall rate of the system as a whole and the greater the concentration of particles in the system, all other conditions being equal. The fall rate of a fine particle (1.50-mm diameter) in a medium of coarse particles (2.00-mm diameter) is 6-7 times higher than for the fine particle in isolation; the fall rate increases with decreased interparticle distance and approaches the system fall rate as the limit. These observations are accounted for in terms of entrainment mechanisms. Systems of mixed particles showed greater divergence in fall rates for fine and coarse particles as the interparticle distance is increased; the fine particles are left behind in the less dense medium.

2166 APTIC NUMBER 17945

Kleese, W.
THE PRESENT APPLICATION OF RHENIUM METAL AND ITS ALLOYS. (Ueber den Stand der Anwendungsmoeglichkeiten von Rheniummetall and seinen Legierungen). Text in German. Metall., 5(7/8):155-156, April 1951.

The use of Rhenium is limited by the scarcity of this element. It is primarily used in the manufacture of thermocouples. Rhenium alloys are used in the manufacture of electric bulbs, rectifiers, electric contacts, compass needles, and wires. Since Re is a good catalyst, it is in the form of Re2O7 for the production of sulfur trioxide from sulfur dioxide and of potassium nitrite from potassium nitrate. The catalytic effect of Re is low in ammonium synthesis when nitrogen and hydrogen react in the non-gaseous state. Its performance is further improved by the addition of iron. Colloidal Re usually is a better catalyst than pulverized Re.

2167 APTIC NUMBER 17971

Klepikova, N. V., L. M. Levin, and Yu. S. Sedunov
QUESTIONS RELATED TO THE THEORY OF AEROSOL PARTICLE PRECIPITATION FROM A FLOW. (Nekotoryye voprosy teorii osazhdeniya chastits aerozolya iz potoka). Text in Russian. Tr. Inst. Prikład. Geofiz. (Leningrad), no. 7:88-115, 1967. 15 refs.

Equations describing the behavior of aerosol particles in a flow are examined. Special consideration is given to the change in concentration of particles in a flow and the precipitation of particles from a quasihyperbolic flow, a potential flow, and from a viscous flow close to the line of symmetry. A method is presented for solving the second-order equation with a small parameter and a higher derivative. Results of computer calculations are tabulated for Pe of 100 to 10 to the eight power, and St of 0 to 0.250.

2168 APTIC NUMBER 20232

Kolerskiy, S. V., and L. S. Ruzer
APPLICATION OF THE METHOD OF TWO AVERAGE RADII VALUES FOR DETERMINING THE DISPERSED COMPOSITION OF AEROSOLS. (Primeneniye metoda dvukh srednikh znacheniy radiusov dlya opredeleniya dispersnogo sostava aerozoley). Text in Russian. Izmeritel. Tekhn., no. 10:37-40, 1968. 5 refs.

It is demonstrated that when measuring the dispersed composition of aerosols by the method of two average values, the problem of determining the distribution parameters, and their errors, is completely solved if errors in determination of average values of the measured quantity are known. Expressions for the normalized logarithm of particle radius, and the standard deviation of these logarithms and their errors as functions of the combination of selected means of measurement and measurement errors, are derived and analysed. The use of diffusion and turbidimetric measurement methods are shown to be the most promising in terms of yielding the least error and making possible measurement of the most monodispersed aerosols.

2169 APTIC NUMBER 17973

Korving, Johannes
THE INFLUENCE OF A MAGNETIC FIELD ON THE TRANSPORT PROPERTIES OF GASES OF POLYATOMIC MOLECULES. Leiden Rijksuniversiteit (Netherlands), Thesis (Ph.D), Leiden, Druco Drukkerijbedrijven N.V., 1968 (?), 76p. 93 refs.

Results from studies of magnetic effects on viscosity for several gases (O2, NO, N2, normal H2, para H2, normal D2, ortho D2, HD, CH4, CD4, CF4, and CO2), and on thermal conductivity (O2, NO, N2, CO, and CH4) are reported qualitatively, and their theoretical implications related to transverse momentum transport are discussed. Viscosity experiments were carried out at room temperature with pressures of 5 mmHg to 1 atm in capillaries 0.96 and 0.58 mm in diameter. Cell design for the thermal conductivity experiments is detailed. The experimental results can be explained only by a theory which takes into account inelastic collisions. Extensive comparison is made with data from other sources.

2170 APTIC NUMBER 18018

Kummler, R. H., M. H. Bortner, and Theodore Baurer
THE HARTLEY PHOTOLYSIS OF OZONE AS A SOURCE OF SINGLET OXYGEN IN POLLUTED ATMOSPHERES. Environ. Sci. Technol., 3(3):248-250, March 1969. 30 refs.

Using experimentally observed solar irradiances and extinction coefficients, the first-order rate constant for the photolysis of ozone to form singlet oxygen is calculated. The minimum concentrations of singlet state oxygen in polluted urban atmospheres are then estimated on the basis of available quenching data. It is shown that these concentrations are sufficient to make singlet state oxygen a much more important oxidizing agent than atomic oxygen in polluted environments. (Author's Abstract)

2171 APTIC NUMBER 20161

Lloyd, Stewart J.
SOME QUALITY MEASUREMENTS. J. Phys. Chem., vol. 22:300-302, 1918. 5 refs.

Accurate solubility determinations were made and tabulated for the following systems: sulfur dioixde in benzol, nitrobenzol, toluol, o-nitrotoluol, and acetic anhydride; aluminum chloride in carbon tetrachloride and chloroform; barium chloride in nitrobenzol; and acid in ethyl acetate. The SO2 determinations were made by bubbling the gas through the solvent until equilibrium was reached. The gas was generated by running concentrated H2SO4 and a saturated aqueous solution of sodium bisulfite into a Wolff bottle from separate dropping funnels. The organic liquids used for the determinations were distilled, dried over CaCl2, and redistilled just before using. Barometric pressure was kept between 756 and 760 mm.

2172 APTIC NUMBER 20851

Malhotra, S. C.
SELECTIVE CATALYTIC REMOVAL OF AMMONIA FROM GASES CONTAINING ACRYLONITRILE. Ind. Eng. Chem. Process Design Develop., 9(2): 338-339, April 1970. 5 refs.

A two-reactor system for the selective oxidation of ammonia in the presence of acrylonitrile was evaluated. The first reactor was a stainless steel U-shaped tube suspended in a salt bath. It contained a pelleted antimony oxide-uranium oxide catalyst. The second reactor was a stainless steel, fixed-bed straight tube heated by an electric tube heater. It contained a pelleted silica-supported bismuth phosphomolybdate catalyst. A layer of stainless steel balls were placed before the catalyst to serve as a preheater. The reaction conditions for the first reactor were adjusted to yield desired concentrations of ammonia, propylene, and oxygen in the effluent. In the second reactor, most of the ammonia present was oxidized by proper adjustment of temperature, contact time, and gaseous linear velocity. When the concentration of ammonia in the second reactor feed was abnormally high, the oxidation of ammonia still approached 90% of the total present. Most of the ammonia in the effluents of the ammoxidation reaction can be oxidized to nitrogen and water, while acrylonitrile is unaffected. In a large-scale operation, the heat recovered could be utilized in the form of superheated steam.

2173 APTIC NUMBER 18168

Maslov, P. G.
THERMODYNAMIC CHARACTERISTICS OF CALCIUM, GALLIUM, INDIUM AND THALLIUM COMPOUNDS. J. Gen. Chem. U.S.S.R. (Eng. Transl.), 29(5): 1387-1397, 1957. 11 refs.

Approximate formulas were obtained for determining the heats of formation, free energies, logarithms of the equilibrium constants of the formation reactions, entropies, and heat capacities at 25 C for calcium, gallium, indium, and thallium mixed halides in the crystalline state and in solution (in HCl and H2O). The thermodynamic properties of a series of compounds of calcium,

gallium, indium, and thallium were then calculated by a method described in previous papers and by the approximate formulas. General expressions for determining the thermodynamic properties of a series of families of crystal hydrates, ammoniates, and other compounds containing calcium were found. The results of calculations for a large group of compounds were compared with experimental data and differences were discussed.

2174 APTIC NUMBER 18174

Meddle, D. W., and R. Wood
METHODS, APPARATUS: NEW PRODUCT RESEARCH, PROCESS DEVELOPMENT AND DESIGN. APPARATUS FOR PREPARING STANDARD AEROSOL ATMOSPHERES. Chem. Ind. (London), No. 47:1635-1637, Nov. 23, 1968. 4 refs.

Certain trace materials of low volability may be present in factory atmospheres in the form of aerosols. Some of the aromatic isocyanates used in the manufacture of polyurethane plastic materials form aerosols of this nature, and the apparatus devised to produce standard atmospheres of these substances is described. After the problems of difficult absorption effects and hydrolysis due to moisture in the diluting air stream were solved, reproducible atmospheres of 2,4-di-isocyanate were produced using a vapor saturation technique employing dry nitrogen instead of air. Other isocyanate atmospheres could be obtained by atomizing toluene solutions of these compounds by injection into a rapid stream of nitrogen. The atmosphere was formed in a containing vessel and allowed to flow through it in a downward direction. The vessel was open at its bottom end, where a collecting probe for isokinetic sampling was situated. The isocyanate solution was supplied to the atomizer from a syringe driven at a constant rate. Containing vessels of several shapes and sizes were evaluated. Benzene and carbon tetrachloride were too volable to be suitable solvents for the isocyanates.

2175 APTIC NUMBER 20231

Mednikov, Ye. P.
THEORY OF ACOUSTIC FLOWS ORIGINATING NEAR VERY SMALL SPHERICAL OBSTRUCTIONS. (Teoriya akusticheskikh techeniy, voznikayushchikh okolo ochen' malykh sfericheskikh prepyatstviy). Text in Russian. Akust. Zh., 14(4):582-589, 1968. 19 refs.

The following characteristics of acoustic flow around spherical obstructions with radius (r) much smaller than the thickness (delta) of the acoustic boundary layer were established from a theoretical study: 1) Around a sphere there forms at least one pair of vortices extending to infinity and not two closing vortices ("internal" and "external"), as in the case with r much greater than delta; 2) The center of vortex formation is still situated on the radius with angular coordinate theta sub 0 equal to 54 degree 43 min but is removed to infinity; 3) The configuration of acoustic flow near a stationary sphere depends on the amplitude of the oscillatory speed but not on the frequency of oscillations; 4) In the limiting case of viscous flow (Re sub 0 equal to 1), the rate of acoustic flow reaches 3-5% of the amplitude of the oscillatory rate in the vicinity of the sphere and about 1% of it at a distance of 50 radii from the sphere. The analytic expressions derived for the stream function and velocity of the acoustic flow are limited to two regions--either close to the sphere or remote from it.

2176 APTIC NUMBER 20072

Mukhlenov, I. P., V. I. Malkiman, and E. A. Kravchenko
KINETICS OF SULFUR DIOXIDE OXIDATION ON A WEAR-RESISTANT VANADIUM CATALYST. J. Appl. Chem. USSR (English translation from Russian of: Zh. Prikl. Khim.), 42(9):1823-1828, Sept. 1969. 17 refs.

An equation derived by G. A. Boreskov et al. on the basis of kinetic studies of sulfur dioxide oxidation was tested under new conditions: high SO2 concentrations in fluidized beds of wear-resistant vanadium catalyst, using high temperatures (500-600 deg) during the first oxidation stage. The catalyst had a V2O5 content of 7.8%, a K2O content of 8.75%, a pore radius of 200-800 A, and a particle size of 0.2-0.32 mm. The test results indicated that the Boreskov equation is applicable to the new conditions.

2177 APTIC NUMBER 20214

Mukhlenov, I. P., M. I. Rudenok, Z. G. Filippova, Ye. U. Lobkina, and V. I. Deryuzhkina.
STRUCTURE OF DURABLE VANADIUM CATALYST FOR OXIDATION OF SULFUR DIOXIDE IN A FLUIDIZED BED. (O strukture isnosoustoychivogo vanadiyevogo katalizatora okisleniya sernistogo angidrida v psevdoozhuzhennom sloye). Text in Russian. Khim. Prom. (Moscow), 43(6):23-26, June 1967. 6 refs.

Experiments, conducted with 7% sulfur dioxide in air, showed that a vanadium catalyst gives maximum activity when its pore radius is approximately 500-600 A. The effect of washing with alkaki sulfates and of roasting time on the structure of the vanadium-saturated substrate (aluminum silicate) was then studied. Specific surface area was found to drop sharply as thermal treatment of the catalyst reached 550-600 C. At 900-1000 C, the catalyst fused into a monolithic structure. These studies demonstrate the possibility of controlling the structure of durable vanadium catalyst over broad limits.

2178 APTIC NUMBER 20811

Mukhopadhyay, S. N. and K. C. Roy Chowdhury
THE COLLECTING EFFICIENCY OF A CYCLONE SEPARATOR. Brit. Chem. Eng., 15(4):529, April 1970. 12 refs.

The collection efficiency of cyclone separators is correlated with the diameter of the cyclone, gas velocity, density of the substance, density and viscosity of the medium, particle size, and dust loading. Baffles introduced into the cyclone also affect the collection efficiency. An increase in efficiency was observed with a decrease in cyclone diameter, increased dust loading, and with an increase in inlet velocity. It decreased with a decrease in particle size. An equation is included to show the correlation.

2179 APTIC NUMBER 17815

Neesby, Torben Emil
PROCEDURE FOR THE CONTINUOUS PRODUCTION OF COLLOIDAL SULFUR. (Fremgangsmaade til kontinuerlig Fremstilling af Kolloidt Svovl). Text in Danish. (Assignee Not Given.) Danish Pat. 52,359. 2p., Nov. 30, 1936. (Appl. Nov. 19, 1935, 3 claims).

Hydrogen sulfide and sulfurous acid, either in their pure form or mixed with other gases, are brought into contact in such a way that they react directly with one another--in the absence of any solvent such as benzol, the alcohols, water, etc.--in a ratio such as will impart the desired properties to the colloidal sulfur. The reaction takes place in a cyclone separator, from which the colloidal sulfur can be continuously removed. The reaction room is thermostatically regulated to a temperature of 5 C or below.

2180 APTIC NUMBER 15586

Newton, Amos S. .. A. F. Sciamanna
METASTABLE IONS IN THE MASS SPECTRA OF N2, NO, N2O, AND NO2. California Univ., Berkeley, Lawrence Radiation Lab., 3p., May 1969. 8 refs.
CFSTI: UCRL-18726

Metastable ions were studied in the mass spectra of the triatomic species carbon dioxide, nitrous oxide, nitrogen dioxide, and hydrogen sulfide. Metastable ions were observed in the mass spectra of nitrogen and nitric oxide. In N2O and NO2, metastable disassociation of N2(+) and NO(+) were also observed. Half lives for the metastable dissociations were studied by various methods. For the reaction N2(+) yields N(+) + N, the half life was independent of source; but the kinetic energy release changed from 0.55 eV from N2 as a source to 0.20 eV from N2O as the source. In regard to the mechanism of the metastable dissociation, three mechanisms were considered: a slow radiation from a higher bound state to a dissociative state, a tunneling mechanism through a low barrier to dissociation, and a predissociation mechanism in which a bound state is crossed by a repulsive state.

2181 APTIC NUMBER 20043

Oya, Shigeo and Hideya Shimizu
GAS ABSORPTION IN COPPER AND COPPER-BASE ALLOYS IN THE LIQUID STATE. (Do oyobi do-gokin yoto no gasu kyushu). Text in Japanese. Imono (Foundry), 38(1):33-49, Jan. 1966. 103 refs.

The absorption of gas from molten copper and copper-base alloys is performed by air within the hearth. This air includes O2, N2, H2, H2O, CO, CO2, SO2, and hydrocarbons, and the amount of each component varies with the type of hearth or its driving technique. The absorption of H2 by the melting copper rapidly increases above 1,100 C with an increase in temperature and by the adding of small amounts of nickel (Cu 100 grams vs. Ni 20 to 30 grams) and decreases slightly by adding Sn or Al. The large molecular compounds such as H2O, SO2, CO, and CO2 may not exist easily within the melting copper or its alloys, and can cause bubbling of these gases when the partial pressure of the gas reaches the atmospheric pressure. The H2O and SO2 gas are produced within the purified copper or CU-Sn alloy, H2O, CO, and SO2 gas within the Cu-Ni alloy. The absorption of SO2 slowly increases with an increase in the temperature and internal pressure of the hearth. The H2 and H2O gases in the hearth air play the most important role in the quality of copper or copper-base alloys. This aspect should further be advanced.

2182 APTIC NUMBER 18200

Palmer, William George
THE USE OF THE COHERER TO INVESTIGATE ADSORPTION FILMS. Proc. Roy. Soc. (London), Ser. A, 106:55-68, Dec. 1924. 8 refs.

The effects on the detector of various gases surrounding the contact of the 'coherer', or losse contact detector, using W-W, Pt-Pt, and C-W contacts were investigated. The critical voltage required to remove the film and bring about metallic contact was measured as a function of adsorbed-film age. In all cases, the critical voltage rose with time. Gases with high critical temperatures, with the exception of CO, displayed changes in stability with aging. The calculated latent heats of evaporation of the gas films tend to show proof of a chemical basis for the adsorption mechanism. The hypothesis that the cohering effect under dielectric stress across the contact might be due to the dispersion of a poorly-conducting film originally lying between the metal surfaces at the point of contact appears to be confirmed by the results of the experiments.

2183 APTIC NUMBER 18165

Pepper, J. M., W. F. Steck, R. Swoboda, and J. C. Karapally
HYDROGENATION OF LIGNIN USING NICKEL AND PALLADIUM CATALYSTS. In: Lignin Structure and Reactions, R. F. Gould (ed.), Advances in Chemistry Series 59, Washington, D. C., American Chemical Society, 1966, p. 238-248, 20 refs. (Symposium sponsored by American Chemical Society, Washington, D. C., Div. of Cellulose, Wood, and Fiber Chem. at the 150th Meeting of the Am. Chem. Soc., Atlantic City, N. J., Sept. 13-14, 1965.

A comparative study was made of the nature of the products obtained by the catalytic hydrogenation of sprucewood meal using Raney nickel and palladium-charcoal catalysts. The effects of a neutral, acid, or alkaline medium on the nature of the phenolic derivatives obtained by such hydrogenations were studied. In each case, the products were complex, the recoveries varied widely, and ring reduction occurred in some cases. All the monomeric products that have been obtained from lignin were found, and the yields from alkaline reactions were always greater than those from neutral reactions. It is believed that arylpropyl units are initially released, some of which then undergo secondary degradation. A model for the lignin substance was proposed which consists of a core fraction to which are attached less condensed side-chain fragments. These fragments may represent the more accessible lignin and may be the origin of the several lignin degradation products obtained by hydrogenation reactions. (Author abstract modified)

2184 APTIC NUMBER 20813

Politzer, Peter and Roger R. Harris
A STUDY OF THE ELECTRONIC DENSITY DISTRIBUTION IN NITRIC OXIDE.
J. Am. Chem. Soc., 92(7):1834-1836, April 8, 1970. 17 refs.

According to elementary molecular orbital theory, the lowered vibration frequency of coordinated NO(+) is correlated with the back-donation of electronic charge into the 2 pi orbital. The same set of molecular orbitals is also assumed to describe both a neutral molecule and its ion. To determine if nitric oxide wave functions corroborate theory, the electronic density distributions in NO and NO(+), and the electrostatic forces exerted by the electrons on the nuclei in NO, were computed and analyzed. Considerable rearrangement of electronic charge occurs in going from NO to NO(+), the latter having greater concentrations of charge in the internuclear region and to the outsides of the nuclei, which presumably accounts for the observed strengthening of the bond in this process. The highest energy electron in NO, the single 2 pi electron, exerts a positive force on the nitrogen nuclei; it pulls each nucleus to the other instead of weakening the bond. The density difference function for nitric oxide is compared with that for carbon monoxide; both the charge buildup in the internuclear region and the localizations of charge to the outsides of the nuclei are considerably greater in the case of CO. The former helps to explain the much higher dissociation energy of CO, while the more prominent lone pairs suggest that CO will be a more effective sigma-donor ligand.

2185 APTIC NUMBER 17921

Reppe, Walter, August Spaeth, and Hans Krzikalla
METHOD FOR THE PRODUCTION OF ORGANIC SULFUR COMPOUNDS. (Verfahren zur Herstellung von organischen Schwefelverbindungen). Text in German. Farbenindustrie (I. G.) A. G., Frankfurt, Germany, W. German Pat. 742, 741. 2p., Oct. 27, 1939. 1 ref. (1 claim).

For producing organic sulfur compounds by conversion of hydrocarbons or halogen containing hydrocarbons with a halogen and sulfur dioxide in the presence of catalysts, it is advantageous to use those halides as catalysts which favor the halogenation to carbon. The following halides can be used: the chlorides of iron, copper, nickel, tin, titanium, zirconium, bismuth, boron, antimony; phosphorus iodide; and the halogen compounds as sulfur. Saturated paraffins such as cetan can be used for hydrocarbons, those obtained at the catalytic hydrogenation of the oxides of carbon at normal or increased pressure, those which arise at the separation of water from oxygen containing products of the catalytic hydrogenation of the oxides of carbon and hydrogenated, or polymerized olefins. The temperature of the process should not exceed 50 C.

2186 APTIC NUMBER 20109

Riley, J. F and R. W. Cahill
ABSORPTION SPECTRUM OF THE OZONE PRECURSOR. J. Chem. Phys., 52(6):3297-3298, 1970. 6 refs.

The absorption spectrum of ozone and its transient precursor at 2, 4, 10, and 16 microseconds was obtained by subtracting the absorption due to ground-state ozone from total ozone absorption recorded experimentally. The spectrum indicates that absorbance of ozone and its precursor is a function of wavelength at various times. The ozone precursor has maximum absorption between 310 and 320 nm. Oscilloscope traces at 365 and 405 nm indicate that formation of the precursor is complete in two microseconds. The half life for the disappearance of the precursor at 334, 365, and 405 nm is five microseconds. Since the kinetics for the disappearance of the precursor are well behaved and yield the same half life at all three wavelengths, the transient does not appear to be vibrationally excited ozone.

2187 APTIC NUMBER 15584

Rothe, Dietmar E. and David J. McCaa
EMISSION SPECTRA OF MOLECULAR GASES EXCITED BY 10 KEV ELECTRONS.
Cornell Aeronautical Lab., Inc., Buffalo, N. Y., TR-165, 70p., Dec. 1968. 26 refs.
CFSTI: N69-19344

The spectra of nitrogen, nitric oxide, water, hydrogen, carbon monoxide, and carbon dioxide, excited by a 10 keV electron beam of 100 micro-amperes current, was investigated in the wavelength range between 2800 and 6600 A, and at gas pressures between 10 and 100 micron Hg. The intensity of the fluorescence of the N2(+) system exceeded that of any other system observed. Spectra of N2, O2, CO, and CO2 were comprised of molecular ion bands with some atomic lines present, whereas the spectra of NO, H2, and H2O primarily consisted of atomic lines. The molecular ion bands with the exception of N2(+), all exhibited some quenching at the higher pressures studied. Relatively strong self-quenching was observed for the first negative system of O2(-), for the comet tail system of CO(-), and for the FDB system of CO2(-). Also a strong relative enhancement of the neutral CO bands by secondary electrons were found at higher pressures. Analysis of the electron beam, luminescence in binary gas mixtures containing nitrogen showed that at gas pressures below 100 micron Hg, the intensity of the N2(+) system is not severely affected by the presence of O2, N2, H2O, or CO. Present data indicated that a lower limit of 500 micron is reasonable for the characteristic pressure for these gases quenching N2(+) radiation. The data obtained in the multiple-component gas mixture indicated that the use of the electron beam to determine the overall density in a low-density flow field appeared promising. With respect to further research, it was proposed that the spectral analysis of the beam luminescence be extended to high gas densities for the pure gases as well as for gas mixtures in order to determine more fully the specific excitation and quenching mechanisms. Further studies are needed to determine the full potential usefulness of the electron beam as a diagnostic technique. (Author conclusions modified)

2188 APTIC NUMBER 17946

Schneider, Armin and Udo Esch
THE REACTIONS BETWEEN MAGNESIUM AND SULFUR DIOXIDE. (Ueber die

Reaktionen zwischen Magnesium und Schwefeldioxyd). Text in German. Z. Metallk., 32(6):173-177, June 1940. 11 refs.

The reaction mechanisms of magnesium and sulfur dioxide were studied using a 350 mm long corundum pipe. Because of the heterogeneous reactions, it was necessary to use not only equal quantities of magnesium for the various test series, but also the same surface. A magnesium wire 2 mm in diameter and 40 mm long was used. The pipe was heated with a thermocouple. The temperature was held constant at plus or minus 5 C. After determining the isotherms, the obtained reaction products were analyzed. Beginning at a temperature of 600 C, the reaction products could be obtained in sufficiently large quantities to permit accurate analysis. Only traces of magnesium sulfide were found at 600 C. The primary reaction at this temperature follows the equation 3Mg + SO2 yields 2MgO +MgS. In the presence of SO2 magnesium is converted to magnesium sulfate. The latter begins to dissociate at 700 C. Beginning at about 650 C, the magnesium vapor pressure controls the reaction speed.

2189 APTIC NUMBER 17821

Schuster, Fritz
NEWEST SPECIFIC HEATS AND HEAT CONTENTS FOR SEVERAL FUEL AND COMBUSTION GASES. (Neueste spezifische Waermen and Waermeinhalte fuer einige brennstoff-und feuerungstechnisch wichtige Gase). Text in German. Waerme, 58(3):39-40, Jan. 19, 1935. 3 refs.

Using the expression mean specific heat equals a + bt + ct squared (Kcal/kg-mol) with a, b and c computed by Bryant for hydrogen, oxygen, nitrogen, carbon monoxide, carbon dioxide, sulfur dioxide, water, methane, and ethane, the following tables were computed: mean specific heats between 0 and t C (in kcal/kg-mol); the heat contents above 0 C (in kcal/kg-mol); the mean specific heats between t1 and t2(C) (in kcal/kg-mol); the mean specific heats between 0 and t C (in kcal/standard cu m); the heat contents above 0 C (in kcal/standard cu m); the mean specific heats between t1 and t2(C) in kacl/standard cu m); the mean specific heats between 0 and t C (in kcal/kg); the heat contents above 0 C in kcal/kg; and the mean specific heats between t1 and t2(C) (in kcal/kg).

2190 APTIC NUMBER 20805

Seshadri, D. N., D. S. Viswanath, and M. R. Kuloor
THERMODYNAMIC PROPERTIES OF THE SYSTEM N2O4 IN REVERSIBLE EQUILIBRIUM WITH 2NO2 AND 2NO + 02. Am. Inst. Chem. Engrs. J., 16(3):420-425, May 1970. 32 refs.

To enable use of nitrogen tetroxide and dioxide in rocketry, the thermodynamic properties were evaluated of the system N2O4 in reversible equilibrium with 2NO2 and 2NO + 02, from 0.005 to 200.0 atm and from 200 to 900 K. Calculations take into account the dissociation of nitrogen tetroxide to nitrogen dioxide, nitric oxide, and oxygen, and the effect of pressure on the equilibrium constants for the reactions. Nitrogen dioxide in reversible equilibrium with nitrogen tetroxide was treated as a monatomic assembly with imperfections given by second and third virial coefficients, and for oxygen, the Lennard-Jones potential parameters were evaluated by using the available second virial coefficients. The entropy and enthalpy values of saturated liquid and vapor and of suprheated vapor are presented in tabular and graphic form and compared with those obtained by previous investigators. At any particular pressure and a given mole fraction of nitrogen dioxide in the equilibrium mixture, there are two temperatures at which the system is stable.

2191 APTIC NUMBER 17972

Shifrin, K. S. and I. B. Kolmakov
INVESTIGATION OF SPECIAL FUNCTIONS REQUIRED FOR THE ESTIMATION OF PARTICLES BY THE METHOD OF SMALL ANGLES. (Issledovaniye spetsial'nykh funktsiy, neobkhodimykh dlya rascheta chastits metodom malykh uglov). Text in Russian. Tr. Vysokog. Geofiz. Inst., no. 8:138-151, 1968. 6 refs.

Simplified equations are derived for solving generalized functions for the scattering of light at low angles from a polydispersed system. This paper is an indirect extension of earlier work on the calculation of a certain class of definite integrals containing the square of the first-order Bessel function.

2192 APTIC NUMBER 18199

Simonette, Ralph
INSTRUMENTATION OF A CHLORINE DIOXIDE PROCESS FOR PULP BLEACHING. Preprint, Instrument Society of America, New York, N. Y., 9p., 1966. (Presented at the 21st Annual ISA Conference and Exhibit, New York, 9p., Oct. 27-27, 1966.)

The Hooker R-2 (TM) process for generating chlorine dioxide requires several instrument control loops which have to be integrated into a safe and economic overall control system. Simple on-line proportional and advanced analog controls are readily adaptable to the process variables. It may develop that the variables will someday be adapted to memorized sequences. To prepare for this event, instrumentation hardware will have to be selected to perform an unfailing task for the present and also be suitable for ultimate requirements. The human operator and the design engineer will have to provide this hardware to accomplish the dependable and economic operation which is generally required by management. (Author abstract modified)

2193 APTIC NUMBER 17882

Sinistri, Cesare
STUDY OF COMPLEX IONS IN MOLTEN EQUIMOLAR NANO3-KNO3. PART 1. THE COMPLEXES CDCL, PBCL, TLCL AND AGSO4. (Studio di ioni complessi nella miscela equimolecolare fusa NaNO3-KNO3 Nota 1: Complessi CdCl, PbCl, TlCl e AgSO4). Text in Italian. Ric. Sci. Rend. A, 2(6):638-643, 1962. 8 refs.

The study of complex-forming phenomena was studied by recording the solubility of an 'indicator' substance (silver chloride) as appropriate complex-forming agents were gradually added. The indicator substance furnishes the chloride anion, which acts as a binder for the 3 cations: thallium, lead, and cadmium. It also

furnishes the silver cation, which acts as a binder for the sulfate anion. Measurements were made at temperatures of 275, 300, and 325 C. Of the three nitrates tested for their effect on the solubility of silver chloride in molten equimolar NaNO3-KNO3, the thallium salt had little effect, the lead salt had a noticeable effect, and the cadmium salt had a strong effect. The data thus obtained was used to calculate the first formation constants for thallium chloride, lead chloride, cadmium chloride, and silver sulfate, in moles/kg of the solvent. The results are tabulated, discussed mathematically, and compared with the values obtained by other authors.

2194 APTIC NUMBER 17923

Smeykal Karl, Horst Dietrich Frhr.v.d. Horst, and Georg Peinze
METHOD FOR THE PRODUCTION OF ORGANIC SULFUR COMPOUNDS. (Verfahren zur Herstellung von organischen Schwefelverbindungen). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt, Germany). W. German Pat.728,223. 2p., Oct. 19, 1940. (1 claim).

A method is presented for producing organic sulfur compounds by the action of a halogen and of sulfur dioxide on saturated aliphatic hydrocarbons or halogen containing hydrocarbons. The oxygen, sulfur, and a halogen containing product of the reaction is converted with phenols alone or in the presence of ammonia or amines. The weakly acid character of the products is of disadvantage for using the products as softeners for polymerides. To avoid this, amines with boiling points of more than 100 C such as hexylamine, heptylamine, octadecylamine, benzylamine, etc. must be added to the product. The quantity of amines added depends on its molecular weight and on the acidity of the product. So much amine is added that the pH value of the product which lies generally between 3 and 4 is raised to between 5.5 and 7.5. Quantities anywhere from 0.1 to 2% by weight of the product are required.

2195 APTIC NUMBER 17962

Smeykal, Karl and Rudolf Kuehn
METHOD FOR THE PRODUCTION OF ORGANIC SULFUR COMPOUNDS. (Verfahren zur Herstellung von organischen Schwefelverbindungen). Text in German. (Farbenindustrie (I. G.) A.-G., Frankfurt, Germany) W. Germany Pat. 721, 892. 2p., July 5, 1939. (2 claims).

New organic sulfur compounds are obtained by conversion of sulfochlorides with mercaptan compounds. The sulfochlorides are obtained by simultaneous reaction of chlorine and sulfur dioxide with saturated aliphatic hydrocarbons. They contain oxygen, sulfur, and chlorine. An acid binding agent is necessary for the process. As mercaptan compounds, methyl mercaptan, ethyl/mercaptan, as well as high molecular mercaptans can be used. As an acid binding agent, dry ammonia is used in gaseous form. Two practical examples are given. In the first case, 100 parts of oxygen, chlorine, and sulfur containing product is mixed with 29 parts of tertiary butyl/mercaptan. Gaseous ammonia is entered into the mixture which is constantly agitated. The temperature of the mixture must not rise above 30 C. The precipitated ammonium chloride is dissolved in water; the oil layer is separated. In the second example, 100 parts of oxygen, chlorine, and sulfur containing product are dropped into a mixture of 30.8 parts of propyl/mercaptan and 100 parts of 20% aqueous sodium lye. The oil obtained in both cases is suitable for softening polyvinyl chloride.

2196 APTIC NUMBER 18164

Snyder, Joe W.
MEASURING BLEACHING TOWER RETENTION TIMES. Tappi, 49(12): 105A-106A, Dec. 1966.

Fluorescent dye-treated pulp nodules added to pulp entering the bleaching towers were used to determine the flow and retention pattern in kraft mill chlorination, caustic extraction, hypochlorite, and chlorine dioxide cells. This was accomplished by observation made through a manhole in the top of the chlorination tower. All luminous particles were counted during one minute intervals, and the time and date of the test, pulp flow rate, and consistency were recorded. A graph of retention time in minutes plotted against percentage of luminous particles was prepared. The shape of the frequency curve, as well as its position with respect to theoretical retention time, provided evidence of the flow pattern.

2197 APTIC NUMBER 18181

Solc, M.
CONTRIBUTION TO THE KINETICS AND MECHANISM OF NITRIC OXIDE OXIDATION. Collection Czech. Chem. Comm. (Prague), 29(9): 2227-2230, 1964. 5 refs.

Experimental results of previous kinetic studies on the mechanism of nitric oxide oxidation show that the reaction order at sufficiently low pressures and low concentrations of NO2 is higher than 2 with respect to NO and lower than 1 with respect to O2. Increase in NO2 concentration leads to the usual third order kinetics. In the mechanism reviewed, however, there appears to be an intermediate, NO3NO, whose existence has never been proved. Another tentative explanation of reaction orders with respect to O2 and NO is proposed involving an intermediate, (NO)2, formed by a trimolar reaction. A rate equation for (NO)2 formation is discussed, and it is suggested that a mechanism analogous to the second one but with an intermediate NO3 rather than (NO)2 would lead to a kinetic equation of order lower than 2 with respect to NO and higher than 1 with respect to O2.

2198 APTIC NUMBER 17823

Stehlik, Blahoslav
THE SYSTEM SODIUM THIOCYANATE - SODIUM NITRATE. (Soustava rhodanidu a dusicnanu sodneho). Text in Czech. Chem. Zvesti, 10(8):533-535, 1956. 1 ref.

The system sodium thiocyanate - sodium nitrate was studied by thermal analysis. The phase diagram obtained had an eutectic point at 226 C and 42% sodium rhodanide. The components were immissible in the solid state. This result disagrees with the

conclusions of Sokolov concerning the formation of mixed crystals, which were based on visual thermal analysis. Melting point depression, calculated assuming the immissibility of the components, agrees well with experimental values.

2199 APTIC NUMBER 20870

Storebo, Per B. and Chaeshik Rho
FORMATION OF A DENSE AEROSOL SIZE DISTRIBUTION. J. Geophys. Res., 75(15):2931-2938, May 20, 1970. 5 refs.

Steady-state aerosol particle size distributions were computed for various supply, production, and removal conditions with 8 size classes per decade. The resulting size distributions are shown in diagrams of variations of the steady-state aerosol size distribution with (a) the mass-supply rate; (b) the spread of particles supplied; (c) the particle supply mode; and (d) the rate of removal. The distributions show that for a dense aerosol, few particles are found below 10 to the minus 7th power cm radius if they are not continuously supplied. Significant numbers of particles below some 0.000001 cm radius are present only if continuously supplied or for a less dense aerosol. For a dense aerosol, increased mass generally means a shift upward in the mode of the aerosol size distribution. A consequence of the upward shift is an initial deposition of radioactive decay products on larger particles. (Author abstract modified)

2200 APTIC NUMBER 18162

Suzuki, Y., and J. Churg
STRUCTURE AND DEVELOPMENT OF THE ASBESTOS BODY. Am. J. Pathol., 55(1):79-91, April 1969. 30 refs.

Formation of asbestos bodies in the hamster lung from instilled chrysotile asbestos was followed by means of light, phase, and electron microscopy. This process took place in the cytoplasm of certain pulmonary cells, especially the alveolar macrophages, and, to a lesser extent, alveolar epithelial cells and septal cells. The successive steps consisted of: (1) phagocytosis of small fragments (often under 1 micron long and 300 A in diameter) and incorporation in cytoplasmic phagosomes; (2) appearance of hemosiderin the cytoplasm of the cells; (3) intracellular transporation of iron micelles from hemosiderin granules into the phagosomes; and (4) progressive concentration of the iron micelles in the vicinity of the fiber and partial clearing of the protein ground substance along the periphery of the phagosome. The central fiber, the coat of hemosiderin, and the investing membrane of the phagosome are considered to be the essential elements of an asbestos body. The presence of uncoated asbestos fibers is noted even after the lapse of 2 years. It is suggested that such fibers, in fact, have undergone phagocytosis, but have been released due to the death of the cell before they became coated with iron. These uncoated fibers probably continue to interact with the cells and may be responsible for the progressive alteration of the lung tissue. (Author's summary)

2201 APTIC NUMBER 18171

Thiessen, Reinhardt
OCCURRENCE AND ORIGIN OF FINELY DISSEMINATED SULFUR COMPOUNDS IN COAL. Trans. AIME (Am. Inst. Mining, Metallurgical, and Petroleum Engr.), p. 2431-2444, 1919. 9 refs.

All coals that have been examined microscopically contain disseminated microscopic grains of pyrite. These are distributed very irregularly and usually occur in colonies. Different coal seams vary in the total content of this form of pyrite, different horizons differ in the total content, and different parts of a section may vary widely in the number of globules present. The majority of globules are roughly spherical in form with a rough surface, and readily break into numerous minute cubes. Coals also contain submicroscopic sulfur, probably as organic sulfur. Although the presence of organic sulfur has been known for a long time, its chemical form is not known. Plants contain sulfur in two forms: as a component of proteins and as non-protein sulfur. The sulfur in proteins is universally present in plants, while the other form occurs only in certain families, but in some of these it occurs in relatively large amounts. On decomposition, the sulfur in plants is released mainly as hydrogen sulfide. Sulfur is absorbed by higher plants as a sulfate; hydrogen sulfide is toxic and must first be oxidized to a sulfate. Hydrogen sulfide may be oxidized through the agency of sulfur bacteria, resulting in sulfates. All plant ashes contain some sulfur. Sulfur is present in peat bogs from 0.29 to 4.21%. Calcium sulfate often crystallizes out when peat is dried slowly. Peats contain pyrite in the form of microscopic grains, similar to those found in the lignites, sub-bituminous, and bituminous coals. (Author summary modified)

2202 APTIC NUMBER 20041

Vasil'eva, A. M.
PROBABLE EUTECTIC COMPOSITIONS OF CERTAIN HIGHLY VOLATILE SUBSTANCES. (O veroyatnom sostave evtektik nekotorykh legkoletuchikh veshchestv). Text in Russian. Zh. Obshch. Khim. vol. 49:432-441, 1917. 7 refs.

Theoretical and experimental data on eutectic composition and temperatures are tabulated for the following systems: ethane with sulfur dioxide, hydrogen chloride, methyl chloride, carbon dioxide hydrogen sulfide, and ammonia; methyl alcohol with sulfur dioxide, methyl chloride, carbon dioxide, hydrogen sulfide, ammonia, and water; methyl chloride with hydrogen chloride; sulfur dioxide with hydrogen chloride; and ammonia with water.

2203 APTIC NUMBER 17811

Vdovenko, M. I., A. Ya. Bayakhunov, and V. F. Kondin
THE OXIDATION OF IRON SULFIDE IN SUSPENSION. (Izucheniye okisleniya sul'fida zheleza vo vzveshennom sostoyanii). Text in Russian. Vestn. Akad. Nauk Kaz. SSR, 17(2):52-61, 1961. 5 refs.

The temperature of sulfide particles and the magnitude of surface reactions were determined in an experimental study of oxidation of iron sulfide at reaction temperatures ranging from

200 to 1400 C. Higher sulfur oxides are formed at low temperatures; lower sulfur oxides, including SO, are formed at high temperatures. The process rate increases more sharply at high temperatures. Kinetic constants for the overall process of iron sulfide oxidation were determined for various temperature ranges.

2204 APTIC NUMBER 20037

Volkovitskiy, O. A., L. I. Yermoshina, and Yu. S. Sedunov.
DETERMINATION OF TURBULENT DIFFUSION COEFFICIENT IN AN AEROSOL CHAMBER. (Otsenka koeffitsiyenta turbulentnoy diffizii v aerozol 'noy kamere). Text in Russian. Tr. Inst. Priklad. Geofiz. (Leningrad), no. 7:59-66, 1967. 11 refs.

A simple method for determining the order of magnitude of the turbulent diffusion coefficient k in an aerosol chamber is presented. Analysis is given for a 15-m diameter 3200 cu m chamber with a centrally placed aerosol point source at a height of 16 m. Satisfactory experimental confirmation resulted in studies with polyethylmethacrylate aerosol with particles ranging 0-85 micron; values for k in this case were 1-1.5 sq cm/sec, both in pure atmosphere and in mist. The accuracy of this method may be improved through the use of a more isodispersed powder and an arrangment which insures a particle discharge velocity commensurate with their precipitation velocity. The same method may be used to evaluate the intensity of mixing of a medium in similar installations.

2205 APTIC NUMBER 17920

Wagner, Kuno
METHOD FOR THE PRODUCTION OF ORGANIC COMPOUNDS CONTAINING ONE OR MORE SULFONIC GROUPS. (Verfahren zur Herstellung von eine oder mehrere Sulfongruppen enthaltenden organischen Verbindungen). Text in German. (Farbenfabriken Bayer A. G., Leverkusen (West Germany)). W. German Pat. Appl. 1,222,048. 6p Dec. 8, 1966. 1 ref. (2 claims).

A method was devised for producing organic compounds containing one or more sulfonic groups by the action of sulfur dioxide or SO2 containing gas on ethylenic unsaturated compounds with at least one double-bonded carbon at the end. The reaction takes place in the presence of the formates of salts of tertiary organic amines or polyamines or of a solution of these in surplus formic acid. The temperatures of the reaction may range from -20 to 180 C, preferably from 40 to 120 C; the pressure is either normal or above. Depending on the ethylenic compounds used (either vinyl compounds or polyvinyl compounds) various sulfones or polysulfones are obtained without reduction of SO2 to elementary sulfur. New formic acid is continuously added to the process in accordance with the amount of CO2 liberated at the reduction. Such additives are used which consist of 1 molecule trimethyl amine and/or triethylamine on 3 molecules of formic acid. The sulfones and polysulfones obtained by the process are valuable compounds for futher syntheses.

2206 APTIC NUMBER 17886

White, C. K., Jr., J. E. Vivian, and Roy P. Whitney
THE SOLUBILITY OF SULPHUR DIOXIDE IN CALCIUM BISULPHITE SOLUTIONS. Paper Trade J., 126(20):141-143, 1948. 12 refs. (Presented at the Annual Meeting of the Technical Association of the Pulp and Paper Industry, New York, N. Y., Feb. 23-26, 1948.)

The solubility relationship for the system CaO-SO2-H2O in the two-phase region (gas and liquid) was investigated at SO2 pressures up to one atm; combined sulfur dioxide concentrations from 0 to 2.1 grams per 100 grams water; and at 10, 18 and 25 C. The experimental procedure consisted essentially of bubbling a gas mixture of sulfur dioxide and nitrogen of constant composition through a lime slurry contained in a gas cell until equilibrium between the two phases was established. Then, by analysis of the liquor and of the exhaust gas, the solubility relationships under the conditions employed were determined. The experimental results are presented in a table in plots of the equilibrium pressure of SO2 against the total SO2 content of the solution for four constant values of the SO2 Concentration. For combined sulfur dioxide concentration values of 0.65, 1.20, and 2.10, the pressure is a linear function of the concentration. If the straight lines of the graphs are extrapolated, each intersects the abscissa at a value of twice the combined SO2 concentration. Thus, in the two-phase region, the equilibrium pressure of SO2 appears to be directly proportional to the 'true free' SO2 concentration of the solution. However, in a few instances, these parameters curve toward the origin as the region of solid precipitation is closely approached.

2207 APTIC NUMBER 20832

Young, J. A., C. W. Thomas, H. A. Wogman, and R. W. Perkins
COSMOGENIC RADIONUCLIDE PRODUCTION RATES IN THE ATMOSPHERE. J. Geophys. , 75(12):2385-2390, April 20, 1970. 9 refs.

To provide a more precise basis for the use of the short-lived radionuclides as tracers of short-term atmospheric mixing and precipitation processes, the atmospheric concentrations of Cl38(37 min), Cl39(55 min), and Na24(15 hours) and some longer-lived radionuclides were measured at altitudes through 19 km and over a considerable range of latitudes. The observed concentration gradients are described, and the apparent relative production rates are compared with theoretical calculations and with some cosmic-ray production rates in argon. The measured Na24 concentrations from 18.3 km agree very well with production rates of argon tanks at that altitude. The Cl38 and Cl39 production rates were about three-fold higher in the argon tank measurements than on exposed filters, suggesting an incomplete collection of the radiochlorine isotopes. This difference in the collection efficiency of the cosmogenic Na24 and chlorine radionuclides suggests a different physical or chemical form. The use of filters with different particle size collection properties should help define these different forms.

2208 APTIC NUMBER 20820

COMMUNITY AIR QUALITY GUIDES: SULFUR COMPOUNDS. Am. Ind. Hyg. Assoc. J., 31(2):253-260, March-April 1970. 26 refs.

The major sulfur compounds detected in the atmosphere are sulfur dioxide, sulfur trioxide, sulfuric acid, sulfates, and hydrogen sulfide. The chief effects of SO2 are eye and respiratory tract irritation, and increased pulmonary resistance. At concentrations of 87 mg/cu m for 2.75 hours, SO3 proved fatal to guinea pigs. Hydrogen sulfide is a respiratory and eye irritant at low concentrations, and at high concentrations can cause respiratory paralysis. It is believed that sulfur compounds produce a more severe effect when they are adsorbed on a particle small enough to penetrate the lung. Sulfur oxides and hydrogen sulfide can also damage vegetation. Materials such as metals, paper, leather, textiles, paint, and ceramics are also damaged by sulfur compounds. It is suggested that the sulfur oxide concentration in the air kept as low as possible to prevent damage to vegetation, deterioration of materials, and to avoid the presumed adverse health effects. Methods for sampling sulfur compounds and their physical and chemical properties are also included.

2209 APTIC NUMBER 20812

Ayres, Stephen M. and Stanley Giannelli Jr.
PHYSIOLOGIC ASPECTS OF AIRWAY OBSTRUCTIVE DISEASE. Advan. Cardiopulmonary Diseases, vol. 4:249-270, 1969. 10 refs.

Physiologic studies suggest that a more realistic classification of chronic obstructive pulmonary disease (asthma, bronchitis, emphysema) must be based on the readily measured criteria of presence and reversibility of airway obstruction and on the degree of hyperinflation. The Hagen-Poiseville equation enables the direct calculation of either expiratory or inspiratory resistance provided both flow rate and driving pressure are known. Flow rate is easily measured by a wire mesh pneumotachygraph, and mouth pressure by a conventional strain guage manometer. Intrathoracic, or pleural, pressure is measured by a catheter positioned in the thoracic esophagus. Conductance-volume ratio is useful for assessing airway obstruction in the presence of varying lung volumes. Because of the close relationship between expired volume and flow rate, a graph of expired flow and lung volume (a flow-volume curve) provides a valuable technique for evaluating the behavior of expiratory flow rate with decreasing lung volume. The location of the points at which pleural pressure equals airway pressure appears to determine the configuration of the flow-volume curve. Distortion of the flow-volume curve in obstructive disease may well be accounted for by the difference between rate of change of actual thoracic gas volume and apparent thoracic volume as measured by the spirogram. More important than absolute differences between asthma and emphysema is the response of the flow-volume curve to a nebulized bronchodilator: flow rates markedly increase following a bronchodilator, and the shape of the flow-volume curve approaches normal with asthma. Certain patients with severe chronic bronchitis may become normal following abstinence from smoking or freedom from air pollutants, and should properly be diagnosed as examples of 'pollutant bronchitis.' Airway resistance is elevated during inspiration but markedly increases during expiration, explaining the striking decreases in expiratory flow shown in the flow-volume curves of emphysema.

2210 APTIC NUMBER 20115

Battigelli, M. C.
EXPERIMENTAL STUDIES ON THE MECHANISM OF PULMONARY INJURY FROM AIR POLLUTANTS. J. Environ. Sci., 1970:25-27, March/April 1970. 6 refs.

Rats were exposed to graphite dust and to graphite mixed with sulfur dioxide at 3 ppm for durations up to 4 months; hamsters were exposed to graphite dust, to sulfate dust, or to either of these dusts mixed with SO2 at 3 ppm for durations up to 3 months. The monitoring of ciliary activity in the trachea; of microbiological population density in the turbinates, in bronchi, and in lung homogenate; the growth of the exposed animals; and histological and hematocrit studies failed to reveal evidence of significant injury in the exposed animals. Although Staph. epidermidis appeared depressed on the surface of the turbinates of all animals exposed to either dust alone or dust in combination with SO2, pulmonary injury appeared unlikely under these test conditions. (Author summary modified)

2211 APTIC NUMBER 20836

Edmundson, Walter F., John E. Davies, and Morris Cranmer
DDT AND DDE IN BLOOD AND DDA IN URINE OF MEN EXPOSED TO 3 PERCENT DDT AEROSOL. Public Health Rept. (U. S.), 85(5):457-463, May 1970. 12 refs.

A study was made to determine the effect of occupational exposure on the levels of dichlorodiphenyltrichloroethane and dichlorodiphenyldichloroethylene in the blood and DDA in urine of four men who sprayed aircraft interiors with an aerosol containing 3% DDT and 1% pyrethrin daily during 4 days. After the first day, little or no relationship was seen between levels of DDT and DDE and the amount of aerosol used or actual spraying time. Excretions of DDA correlated only slightly to amounts of spraying time. Relative heights of DDT and DDE in blood related more to biological differences of the men and to previous exposure. Levels of DDE are considered to reflect the length of lifetime absorption of DDT, degree of tissue saturation by DDT and DDE, and the intake-excretion balance of DDT and its metabolites. The DDA producing enzyme system appears to respond to rapidly changing concentrations of circulating DDT. (Author summary)

2212 APTIC NUMBER 20206

Elton, Sheila, Joanne Szajnar, and Ralph Smith
SPECTROGRAPHIC ANALYSIS OF INHALED AIR POLLUTANTS IN LUNG TISSUE. Develop. Applied Spectr., vol. 6:87-98, 1968. 19 refs. (Proc. 18th Aron. Spectroscopy Symposium, Chicago, May 1967, W. K. Baer, A. J. Perkins, and E. L. Grove (eds), New York, Plenum.)

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The lungs of animals exposed to air pollutants in city air and animals exposed to clean filtered air only were analyzed and the results compared. A semiquantitative emission spectrographic method for the determination of 18 trace metallic elements and 5 major constituent elements of lung-tissue ash was used. Dry ashing was used to concentrate the metals in the tissue prior to dc-arc excitation of sample and internal standard. Direct-current arc excitation in an argon-oxygen atmosphere by using an enclosed water-cooled Stallwood jet was employed. No significant difference was found in the concentration levels of the elements studied for the two groups. (Author abstract modified)

2213 APTIC NUMBER 20111

Gardner, M. J. and R. E. Waller
ENVIRONMENTAL FACTORS IN THE AETIOLOGY OF LUNG CANCER AND BRONCHITIS. Brit. J. Prevent. Social Med. (London), 24(1):58-60, 1970. 8 refs.

The conclusions concerning the relationship for air pollution and lung cancer in a previously published article (Ashley, 1969) are opposite to those reported earlier in other studies. It is believed that the use of a 'modified Standardized Mortality Ratio'(S.M.R.) modified the results of the study. A number of environmental factors, in particular air pollution and population density, are related to town size, and part of their association with mortality will be lost if the S.M.R.s are used. The S.M.R.s from lung cancer in males for County Boroughs in three urban aggregates showed a gross distortion of the towns in the conurbations. The correlation between populations and the S.M.R. from lung cancer in males for towns outside the conurbation suggested the procedure used did not eliminate the influence of town size. The correlation between sulfur dioxide and the two S.M.R.s are +0.26 and -0.20 respectively; the published value of -0.23 for the latter coefficient for the data could not be reproduced. It is suggested that this reversal from a positive to a negative coefficient is due to the inappropriate modification. Since the basic material is inappropriate, it is recommended that the further analysis and conclusions of Ashley be regarded as invalid.

2214 APTIC NUMBER 20827

Godfrey, S., P. L. Kamburoff, J. R. Nairn, N. M. C. Connolly, J. Davis, E. Packman, and C. S. Samuels
SPIROMETRY, LUNG VOLUMES AND AIRWAY RESISTANCE IN NORMAL CHILDREN AGED 5 TO 18 YEARS. Brit. J. Diseases Chest (London), 64(1):15-24, 1970. 21 refs.

Spirometry, lung volumes, and airway resistance were measured in 382 London school children aged 5 to 18 years. The spirograms were recorded with a wet spirometer and the lung volumes and resistance measurements were made with a body plethysmograph. All measurements were related to height, arm span, and age. There were highly significant correlations with all the measurements; those with arm span were as good as those with height. There was virtually no change in specific airway conductance with growth. The values for all tests compared favorably with those from other studies. Apart from those reported here, very few measurements of airway resistance in normal children are available. (Author summary)

2215 APTIC NUMBER 20092

Green, Gareth M.
PULMONARY CLEARANCE OF INFECTIOUS AGENTS. Ann. Rev. Med., vol. 19:315-336, 1968. 116 refs.

Because of its structure and function as respiratory organ, the lung is equipped with defense mechanisms for inactivating or removing inhaled inert or infectious particles. A major area of defense is against inhaled infectious agents because of their capacity to increase in mass and number. The necessity for rapid inactivation of the organism's viability places a premium on the performance of microbicidal mechanisms. In the healthy lung, the primary microbicidal mechanism appears to be the alveolar macrophage. Unsuccessful performance by this system leads to inflammation. The functional state of the alveolar macrophage system is influenced by genetic endowment, prior immunological experience, the metabolic state of the host, diseases in other systems, concurrent pulmonary diseases, and the simultaneous activity of a large number of exogenous agents that alter macrophage activity. Factors that alter macrophage activity may affect its behavior in a highly specific manner, as in specific immunity, or nonspecifically, as in toxic poisoning. In the latter case, defense against many infectious and nonliving materials may be altered. The alveolar macrophage is central to the defense of the lung against infectious agents, and may be central in the genesis of pulmonary pathology. (Author conclusions modified)

2216 APTIC NUMBER 20220

Gusev, M. I.
NEW STUDIES ON THE EFFECT OF LOW LEAD CONCENTRATIONS ON THE HUMAN ORGANISM. In: Limits of Allowable Concentrations of Atmospheric Pollutants. V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 19-28. 19 refs. (Translated by B. S. Levine.)

In view of existing disagreements on the mechanism of porophyrin metabolism disturbances caused by exposure to lead, urine samples from 100 children living in the vicinity of a cable plant and from 11 children living in the vicinity of a lead smelting plant were analyzed for coproporphyrin. The results were compared with coproporphyrin elimination in 100 children living in a section of the city free of lead discharging industrial plants. Coproporphyrin eliminated in the first group of children ranged from 3.38 to 15.80 micron, with an average of 8.19 micron per eight-hr period. The minimum coproporphyrin elimination in the group exceeded that of the control group by 1.5 micron; the maximum, by 4.11 micron; and the average, by 1.69 micron. The average diuresis was 244 ml. Among the children from the area of the smelter, the average diuresis was 257 ml. Corproporphyrin ranged from 3.87 to 31.07 micron, with an average of 10.74 micron. As compared with the control group, minium indexes rose by 2.03 to 3.87 micron and maximum, by 11.05 to 31.07 micron. In the

control group, coproporphyrin was 2.03 to 11.05 micron. The amount eliminated per eight-hr periods was about 6.5 micron, with an average diuresis of 223 ml. In further studies, the average urinary lead content of 56 children residing near a lead smelter was found to be 0.023 mg/l as compared with 0.015 mg/l in control children.

2217 APTIC NUMBER 18128

Hallee, T. James
DIFFUSE LUNG DISEASE CAUSED BY INHALATION OF MERCURY VAPOR. Am. Rev. Respirat. Diseases, 99(3):430-436, March 1969. 15 refs.

Acute exposure of a five-member family to varying amounts of mercury vapor is reported. Severe interstitial pneumonia and hypoxemia developed in the father, who was most affected. Pulmonary function studies performed 25 days after exposure revealed moderate restrictive lung disease and mild hypoxemia. He was treated with oxygen, antimicrobial drugs, and dimercaprol (BAL). Because of continued dyspnea on exertion five months after exposure and evidence on arterial blood gas analysis of intrapulmonary shunting, a lung biopsy was performed. The biopsy revealed minimal interstitial fibrosis, and the patient remained mildly dyspneic on exertion 1 year after exposure. Symptoms and treatment of the other members of the family are given.

2218 APTIC NUMBER 20110

Henry, Mary C., John Findlay, James Spangler, and Richard Ehrlich
CHRONIC TOXICITY OF NO2 IN SQUIRREL MONKEYS. III. EFFECT ON RESISTANCE TO BACTERIAL AND VIRAL INFECTION. Arch. Environ. Health, 20(5):566-570, May 1970. 9 refs.

Exposure to 10 ppm nitrogen dioxide for one month or 5 ppm for two months has an effect on the respiratory function of squirrel monkeys. During the one month period, minute volume increased due to increases in both tidal volume and respiratory rate. The minute respiratory volumes of monkeys during a two month exposure to 5 ppm did not show significant elevation, but the tidal volume was depressed. Subsequent challenge with airborne K. pneumoniae produced symptoms of infection in control monkeys and also in those maintained in an NO2 environment. However, the control monkeys recovered from the infection while three of the 11 NO2-exposed monkeys died. The bacterial clearance was also reduced after NO2 exposure. Susceptibility to viral infection was enhanced with the NO2 exposure was initiated 24 hours after infectious challenge. All the monkeys exposed to 10 ppm NO2 died within two to three days after challenge. One of three exposed to 5 ppm died. Although all the control monkeys had symptoms of viral infection, no deaths occurred in this group. Nitrogen dioxide has been shown to have an effect on lung macrophage viability, and alteration of phagocytic activity in lung tissue be responsible for the decreased resistance to bacterial infection.

2219 APTIC NUMBER 20209

Hurst, Daniel J., Donald E. Gardner, and David L. Coffin
EFFECT OF OZONE ON ACID HYDROLASES OF THE PULMONARY ALVEOLAR MACROPHAGE. Preprint, National Air Pollution Control Administration, Cincinnati, Ohio, Div. of Health Effects Research, 16p., 1969 (?). 33 refs.

New Zealand rabbits were exposed for 3 hrs. to various concentrations of ozone, ranging from 0.25 to 7.0 ppm. Alveolar macrophages were procured by lavage and purified by centrifugation. Low levels of ozone depressed the activity of acid phosphatase, beta glucuronidase, and lysozyme in the macrophage. Twenty-four hours after a 3-hour exposure, the enzymatic activities returned to almost normal. After exposure to ozone, the macrophages exhibited an intracellular rearrangement of hydrolytic activity with the lysosomal fraction losing and the soluble cellular extract gaining activity. Any alteration of the functions of the alveolar macrophage by a pollutant could have serious effects on the ultimate health of the animals, since it is important not only in the lungs' defense against inhaled particulates, but also in interferon production and in the initiation of antibody synthesis. (Author abstract modified)

2220 APTIC NUMBER 20055

Karamzina, N. M.
EFFECT OF BERYLLIUM OXIDE AND BERYLLIUM ALLOYS WITH ALUMINUM ON GLYCOLYSIS IN THE LUNG. (K otsenke sostoyaniya glikoliza v legochnoy tkani pri vozdeystvii okisi berilliya i ego splava). Text in Russian. Toksikol. Novykh Prom. Khim. Veshchestv, no. 9:193-198, 1967. 4 refs.

Intratracheal introduction of beryllium oxide and of a beryllium-aluminum alloy resulted in a sharp increase in lactic acid in the rat lung tissue. A certain depression of hexokinase activity in the lung tissue was detected. These tests did not reveal any change in activity of dehydrogenase for phosphoglycerine aldehyde. Changes brought about by beryllium-aluminum alloy were in every case weaker and more rapidly normalized than with beryllium oxide. This is in agreement with data related to weighted pulmonary quotient.

2221 APTIC NUMBER 20828

LaNier, Marshall, Vernon E. Rose, and Charles H. Powell
A PRELIMINARY STUDY OF NATIONAL HEALTH HAZARDS FROM LASERS. Am. Ind. Hyg. Assoc. J., 31(1):60-68, Jan.-Feb. 1970. 6 refs.

A nationwide epidemiologic study was made of laser operations to evaluate potential health hazards and their control. A total of 200 establishments constituted the survey sample, estimated as comprising 23% of all lasers - including home built - in the United States. Extrapolated, the survey figures indicate that 25,000 to 30,000 persons work in or around laser areas. A significant percentage of these potentially exposed persons do not work with the laser. Health resources provided for laser operations appears to vary directly with the size of the using organization. The application of engineering controls to reduce the potential of exposure to laser energy was not consistent. Only three cases of permanent eye damage resulting from the use

of laser systems have appeared in the literature. Little information has appeared on temporary damage or other injuries. This scarcity of recorded information, compared to the number of undocumented reports of laser injury, indicates a need for some type of laser accident reporting and evaluation system.

2222 APTIC NUMBER 20122

Momotani, Hiroshi, Toshio Toyama, Fujio Kumajaya, and Susumu Ohsawa
ESTIMATION OF CARBON MONOXIDE HEMOGLOBIN LEVEL BY EXPIRED AIR. (Kokichu issankatanso nodosokutei nigoru ketsueki chu issankatanso hemoglobin nodo no suitei). Text in Japanese. Sangyo Igaku (Jap. J. Ind. Health), 12(2):32-36, Feb. 20, 1970. 8 refs.

Though it is customary to measure the percentage of carbon monoxide hemoglobin (COHb) in studying CO poisoning, most techniques are inadequate for a population survey. In the present study, samples of expired air were collected in polyvinyl bags according to Jone's 20-sec breathing method and analyzed with a nondispersive infrared analyzer. Interference by carbon dioxide and water vapor was avoided by the use of soda lime and silica gel, respectively. Blood COHb percentage, as measured by the microdiffusion method, correlated well with the expired air CO concentration in low concentrations. A significant correlation was observed between the CO concentration of the expired air and the number of cigarettes smoked daily by a group of 119 medical students. The average expired-air CO concentration of 276 Tokyo school children was 1.5-2.0 on clear autumn days, when atmospheric CO was about 1.0 ppm. On the other hand, the winter average concentration for 1383 school children in rural Japan was 3.0-5.5 ppm, with or without the presence of heaters in the classrooms. Ambient CO air levels were 0.5-3.0. Traditional rural heaters are thought to be the main source of expired-air CO, but endogeneous CO may explain why the amount of CO in expired air is higher than ambient values.

2223 APTIC NUMBER 17901

Murphy, Guillermo
CHRONIC MANGANESE POISONING MANGANESE PARKINSONISM. (Intoxicacion cronica por manganeso Parkinsonismo manganico). Text in Spanish. Prensa. Med. Arg., 55(13):564-568, May 1968. 14 refs.

Five cases of chronic manganese poisoning are studied, four of which have their origin in the inhalation of the dust of a manganese ore (pyrolusite); the fifth, from the inhalation of manganese vapors. The risk of this disease was increased by the introduction of pneumatic hammers into mining procedures. Three of the four 'dust' cases were contracted by workers in the same poorly ventilated tunnel, and the fourth worker had been assigned to an underventilated pit, 15 meters deep and 3 meters in diameter. Mines where atmospheric dust is kept down with water do not have such problems. The vapor-inhalation case involved a furnace stoker in a ferromanganese foundry, again poorly ventilated, with a low ceiling and humid atmosphere. Exposure time for the five cases was from 6 months to 2 years. Early symptoms are asthenia, withdrawal, irritability, character alterations, headaches, hypersomnia, and finally psychiatric disturbances. A kind of parkinsonism also occurs, whose subjective symptoms are a feeling of rigidity and heaviness in the lower limbs. Frequent stumbling, muscular spasms, dysarthria (which in two cases led to total loss of speech), sialorrhea, bradykinesia, and fits of laughing or weeping also occur. Three of the five cases exhibited a very noticeable swelling of the facial features and the body in general. Lingual dyskinesia occurred in one case, surprisingly similar to the condition caused by certain phenothiazine derivatives. EDTA gives limited relief from the symptoms of this disease, and some success was obtained with DOPA, a drug often employed in parkinsonism cases.

2224 APTIC NUMBER 20131

Pepys, J.
ALLERGY. PULMONARY HYPERSENSITIVITY REACTIONS TO INHALED ORGANIC DUSTS. Trans. Med. Soc. London, vol. 85:44-49, May 28, 1970. 21 refs. (Presented at the Medical Society of London, Dec. 9, 1968.)

Immunological mechanisms responsible for pulmonary hypersensitivity reactions due to inhaled antigens are correlated with clinical and other manifestations in affected subjects. Atopic subjects, probably about 10%, have a constitutional predisposition to develop Type I immediate anaphylactic sensitivity following everyday limited exposure to organic antigens, with re-exposure resulting in rapidly developing reactions in the bronchi and asthma. These reactions are mediated by non-precipitating, skin sensitizing antibody known as reagin, now identified as the immunoglobulin IgE, and eosinophil cells are a characteristic feature. Non-atopic subjects may be sensitized by repeated, intensive exposure leading to Type III, Arthus sensitivity, which is perhaps responsible for damage to the peri-bronchial tissues in pulmonary aspergillosis and the peripheral alveolar tissues in a farmer's lung type of disease, extrinsic allergic alveolitis. Intensity of exposure influences the production of symptoms. Intermittent exposure is associated with characteristic attacks coming on acutely after an interval of five to six hours, initiated by systemic reactions, while regular frequent exposure is associated with insidious development of disease. The particle size of the dusts influences their distribution in the respiratory tract, added to which is the capacity of the microflora in some cases to grow in the lungs.

2225 APTIC NUMBER 20249

Perkins, Norman M. and John R. Goldsmith
SEASONAL VARIATIONS IN MORTALITY. Preprint, 23p., 1963. 26 refs. (Presented at the International Congress of Biometeorology, Pau, France, Sept. 2-7, 1963.)

A statistical study was based on mortality data collected from Australia, Great Britain, Sweden, continental United States (California, Michigan, New York, Arizona, New Mexico, Los Angeles, Chicago), Hawaii, and Puerto Rico. Particular attention was given to circulatory and respiratory diseases, where data was available. Comparisons were made according to race, sex, and urban-versus-

rural residence. A comparison of northern and southern hemispheres gives curves that are 6 months out of phase. Respiratory and circulatory diseases show marked seasonal variations and substantially affect the total mortality curve. Cancer mortality is not seasonal. The shift of maximum mortality from summer to winter in New York and Chicago is attributed to improvements in sanitation in those cities over the past 50 years. During this period, digestive diseases declined and respiratory diseases increased in their respective contributions to mortality. Seasonal variations are less prominent in even-climated areas like Hawaii and California, but the seasonal mortality pattern is still in evidence. Traditional methods for the statistical analysis of the data presented are considered inadequate.

2226 APTIC NUMBER 18147

Permutt, Solbert and P. Caldini
VASCULAR TONE, VASCULAR DISTENSIBILITY, AND ALVEOLAR DEADSPACE IN LUNGS. In: Aspen Emphysema Conference, 10th, 1967, p. 115-116, June 1967.

The effect of the level of left arterial pressure on the ratio of the pulmonary arterial pressure to the left arterial pressure at a constant pulmonary flow and alveolar pressure was studied. If the pressure surrounding the small blood vessels of the lungs were alveolar pressure, and if these vessels were easily collapsible but indistensible, the ratio of pulmonary arterial pressure to left arterial pressure should be 0 when the left arterial pressure is less than alveolar pressure in all parts of the lung. It should be 1 when left arterial pressure is greater than alveolar pressure in all parts of the lung. As long as the ratio of pulmonary arterial pressure to left arterial pressure was less than 1, an increase in left arterial pressure was accompanied by a decrease in alveolar deadspace. When the left arterial was raised, the ratio exceeded 1. The linkage between changes in the ratio and alveolar deadspace suggests that changes in both are related to the number of perfused vessels. Since the left arterial pressure must exceed alveolar pressure to achieve maximum recruitment it is believed that some of the vessels are surrounded by a pressure greater than alveolar pressure. The increase in this surrounding pressure is related to such vascoactive agents as serotonin.

2227 APTIC NUMBER 17907

Bylander, Rajmar
PULMONARY DEFENCE MECHANISMS TO AIRBORNE BACTERIA. Acta Physiol. Scand. Suppl. (Oslo), no. 306, 84p., 1968. 82 refs.

The ability of the guinea pig lung to eliminate inhaled non-pathogenic bacteria was investigated. Guinea pigs were exposed to an aerosol of viable Escherichia coli and killed bacteria of the same species, labeled with S 35. In normal animals, the number of radioactive bacteria was reduced about 50% 5 hrs after exposure; reduction was more rapid between 0 and 2 hrs. The number of viable bacteria decreased more rapidly; at 5 hrs after exposure, 16% of the viable bacteria remained in the lung. Mechanical elimination accounted for 48% of the total reduction of viable bacteria between 0 and one-half hours after exposure. It was also shown that most of the viable bacteria eliminated through the trachea were situated outside phagocytes. Guinea pigs inoculated intraperitoneally with ethanol after bacterial exposure and guinea pigs which were exposed to coal dust or fresh cigarette smoke 3 weeks prior to the bacteria exposure were examined. More radioactive bacteria were found in the lungs of the treated animals than controls, which indicated that the mucous transport was impaired by ethanol. Ethanol also caused a reduction in the mechanical elimination of viable bacteria. The results from coal dust-exposure experiments showed that the reduction of killed, radioactive bacteria was equal to the control values, indicating that the mucous flow was not affected. An increased number of viable bacteria found in the coal dust-exposed animals indicated that the efficiency of the bactericidal mechanisms were impaired. In cigarette smoke-exposed animals, the reduction of killed, radioactive bacteria was lower than the controls which was interpreted as an effect on the mucous flow. No significant differences in the reduction of viable bacteria was detected. (Author summary modified)

2228 APTIC NUMBER 20198

Smith, Ralph G., Joanne Szajnar, and Lawrence Hecker
STUDY OF LEAD LEVELS IN EXPERIMENTAL ANIMALS. Environ. Sci. Technol., 4(4):333-338, April 1970. 10 refs. (Presented at the Division of Industrial and Engineering Chemistry, Symposium on Air Conservation and Lead Division of Water, Air, and Waste Chemistry, 157th National Meeting, Minneapolis, Minn., April 14-15, 1969.)

A large number of rodents was maintained in chambers and exposed to air from an intersection in central Detroit. A comparable group of animals was maintained in identical fashion, but supplied with filtered air that was presumed to contain no lead content. Although lead levels tended to be higher in the exposed group, the difference was significant only in the case of bone levels. Both rabbits and guinea pigs displayed significantly increased bone lead levels. The increases are attributed to the inhalation of approximately 2.5 micrograms/cu m of lead for a period of nearly four years. Estimates indicate that although the lead intake by ingestion was considerably greater than that by inhalation, lead is more efficiently absorbed by inhalation. (Author abstract modified)

2229 APTIC NUMBER 20087

Tansy, M. F. and R. P. Roth
PIGEONS: A NEW ROLE IN AIR POLLUTION. J. Air Pollution Control Assoc., 20(5):307-309, May 1970. 15 refs.

A study was conducted to ascertian the tissue lead content of randomly procured Philadelphia city pigeons versus rural pigeons, in which the lead content of both groups was assayed by means of atomic absorption spectrophotometry. Tissues were weighed, then vacuum dried at 25 in. pressure to constant weight in 19 hours, and organic matter was removed by wet chemical digestion with a mixture of perchloric and nitric acids. After decomposition of organic matter was complete, the mixture was heated to drive off the volatile constituents, and the lead

determinations were made. With one exception, lead concentrations were greater in feathers, nails, beak, femur, liver, and kidney of birds collected from the downtown Philadelphia area then in the feathers and corresponding hard and soft tissues of the country pigeons, while there was no appreciable difference between the lead levels in the blood, tongue, skeletal muscle, brain, trachea, crop, heart, lung, pancreas, spleen, peripheral nerve, and gastrointestinal tract. Possible sources of lead intake were examined and references to past literature were cited, indicating that the most significant general source of biological lead is probably atmospheric.

2230 APTIC NUMBER 20132

Villiers, A. J. de
THE EFFECTS OF AIR POLLUTION ON HEALTH. Occupational Health Rev. (Ottawa). 20(3-4):25-44, 1968-69. 62 refs. (Presented at the Banff Conference on Pollution, 1968.)

Sufficient evidence indicates that atmospheric pollution in varying degrees does affect health adversely, contributing to an excess of deaths, increased morbidity and the earlier onset of chronic respiratory diseases. Under ordinary circumstances, the cleansing mechanisms of the lungs are highly efficient, and the large solid particles and droplets are screened out by nasal hair or the mucous secretions of the upper respiratory tract. Particles below 1 micron usually penetrate the deep lung regions, and changes from the normal occur when the defenses such as removal by scavenger cells are damaged or overwhelmed by high concentrations and/or repeated exposures. Generally, two major types of community air pollution occur: a 'reducing' form consisting largely of soot, fly ash, other material, and sulfur dioxide, an atmosphere characteristic of London-type smog; and an 'oxidizing' form containing carbon monoxide, hydrocarbons, and photochemical decomposition products such as oxides of nitrogen, ozone, peroxyacetyl nitrate and olefin characteristic of the Los Angeles-type smog. The most dramatic effects of pollution were reported in association with the reducing types of atmospheric pollution. Considerable differences occur between smokers and non-smokers concerning mortality from lung cancer and cardiovascular disease, and the prevalence of symptoms indicative of chronic non-specific respiratory disease. Climatic, socio-economic, and occupational factors are also implicated in the effects of pollution. An increasing incidence of disease has brought a spiralling of the monetary cost of ill health. Lost wages and losses in productivity due to chronic respiratory diseases were estimated at approximately one billion five hundred million dollars in 1967, and to these must be added the costs for day-to-day from hospital care and a variety of other indirect factors.

2231 APTIC NUMBER 18139

Worth, G., K. Muysers, and H. J. Einbrodt
ON THE CORRELATION OF FINDINGS FROM X-RAY, PATHOLOGIC-ANATOMIC, AND DUST STUDIES ON COAL MINERS WITH PNEUMOCONIOSIS. (Ueber die Korrelationen von roentgenologishchen, pathologisch-anatomischen und staubanalytischen Befunden bei der Kohlenbergarbeiterpneumokoniose.) Text in German. Beitr. Silikose-Forsch., 96:1-42, 1968. 12 refs.

X-ray findings, chemical dust analyses and the autopsy results of 54 Ruhr coal miners are compared. In coal miners without silicosis, the mean values of total dust and coal dust is significantly less than those of the coal miners with silicosis. There are no significant differences in the amounts of coal dust between the groups with various grades of silicosis. Mineral dust and $SiO_2$ are significantly higher in coal miners with severe silicosis than in the non-silicotic miners, but there are no significant differences between the experimental groups with silicosis. However, the higher dispersion of the individual values of total dust and its components does not permit an assessment of the existence and the grade of silicosis. Although a lung without silicosis in no case contained more free $SiO_2$ than 0.39 g/100g lung dry weight severe silicosis also occurred with $SiO_2$ values as low as 0.1/100g. The mean values of total dust and its components increase with the length of dust exposure. Results showed that once exposure ends coal dust is more easily eliminated from the lungs than mineral dust. Typical generalized pneumoconiotic shadows are caused by fibrosis in the tissue reacting to the dust rather than as a result of inhaling it.

# EFFECTS – PLANTS AND LIVESTOCK

2232

APTIC NUMBER 20045

AIR POLLUTANTS COMBINE TO DAMAGE CROPS. Agri. Res., 15(4):3-4, Oct. 1966.

Combined effects of ozone and sulfur dioxide on leaf quality of a number of plants as tobacco and spinach and on the cut yields of crops such as cereal grains, grapes, beans, and citrus fruits are reported. Damage occurred at levels below those at which either one of the pollutants alone has an adverse effect. Tobacco leaf suffered weather fleck when exposed to ozone at 3 pphm together with sulfur dioxide at 25 pphm for periods of 2-4 hours. Use of a special U-tube chromium trioxide scrubber ensured accurate ozone readings with the Mast ozone meter in the presence of sulfur dioxide.

2233

APTIC NUMBER 17881

Cannon, Helen L. and Jessie M. Bowles
CONTAMINATION OF VEGETATION BY TETRAETHYL LEAD. Science, vol. 137:765-766. Sept. 7, 1962. 4 refs.

Vegetation growing near highways was tested for tetraethyl lead in three areas: Denver, Colo.; Canandaigua, N. Y.; and Washington County, Md. Washed pasture grass near Denver contained 3000 ppm (in ash) near major intersections and more than 50 ppm for 500 ft downwind. In Canandaigua, vegetables grown less than 50 ft from the street averaged 115 ppm lead and ranged from less than 10 to 700 ppm in contrast to an expected background of less than 5 to 20 ppm. Samples of vegetables collected within 25 ft of roads in Washington County contained an average of 80 ppm lead, but samples collected more than 50 ft from a road averaged only 20 ppm lead.

2234

APTIC NUMBER 20254

Engle, R. L. and W. H. Gabelman
INHERITANCE AND MECHANISM FOR RESISTANCE TO OZONE DAMAGE IN ONION, ALLIUM CEPA L. Proc. Am. Soc. Hort. Sci., vol. 89:423-430, 1966 13 refs.

Tipburn from ozone in yellow globe onions was studied; onion leaf discs were subjected to controlled ozone fumigation in a microchamber and were examined under a low power microscope. Correlations between genetic resistance and susceptibility to ozone damage and stomatal responses were obtained. Water loss by apparent transpiration was also used as a measure of sensitivity of stomata to ozone. Results indicate that resistance to ozone damage in onion leaves is controlled by a dominant genetic system which appears to regulate the sensitivity of the membranes of the guard cells to ozone. In the presence of ozone, the membranes of the guard cells in the resistant plants lose their permeability and leak, thereby closing the stomata. The membranes of the guard cells on the susceptible plants are not sensitive to ozone. Apertures remain open, allowing ozone to pass into the substomatal cavity and thus cause damage to the surrounding tissue. The damage produced on the susceptible plants was very similar to field type damage produced by natural occurring ozone. (Author abstract modified)

2235

APTIC NUMBER 17822

Garber, K.
THE INFLUENCE OF FLUORINE CONTAINING EMISSIONS ON PLANTS. (Die Beeinflussung der Pflanzenwelt durch fluorhaltige Immissionen). Text in German. Angew. Botan., vol. 40:12-21, 1966. 18 refs. (Presented at the Botanikertagung, Bonn, Sept. 10, 1965.)

Typical symptoms of plant damage by fluorides are mottling of the leaves, bleaching of the leaf margin and tips, and necrosis and rolling of the leaves. The symptoms alone are sometimes not enough to make a correct diagnosis. It is necessary to determine the F-content of the plant. Several methods are available, such as distillation of the ashed substances with perchloric acid or sulfuric acid and subsequent determination of the F-content of the distillate by colorimetry or titrimetry. The natural F-content of plants must be known. It usually lies between 0.05 and 2.5 mg per 100 g dry substance. A table listing the natural F-concentrations of various types of plants is given. Tree barks can be used for the analyses if leaf samples are not available. A clear difference exists of F-concentration between the bark facing the F-source and the bark facing the opposite direction. To diagnose injuries, plants can be exposed in the pots in the polluted area under equal conditions. In one instance, the injuries were traced to sulfur dioxide rather than F-containing emissions. This shows that a higher F-content in the plant than is natural does not always mean that the visible injuries are a consequence of the higher F-content. Soluble NaF or KF dust on plants may reduce the chlorophyll content of plants. The sensitivity of the plants to fluorides varies and is influenced by the site, nutrition, and the climate.

2236

APTIC NUMBER 20183

Godzik, S. and Z. Pis ornik
TRANSPORTATION OF AESCULUS HIPPOCASTANUM L. LEAVES FROM AREAS OF VARIOUS AIR POLLUTION. Bull. Acad. Polon. Sci., Ser. Sci. Biol., 14(3):181-184, 1966. 5 refs.

Investigation of the speed of water loss in leaves of Aesculus trees showed that those from the cokery area loss water faster from an area of low pollution, while no significant difference was seen between leaves from the cokery area with and without visible injury symptoms. In order to investigate the water loss suffered by the upper or lower leaf side, the opposite surface of the leaf was covered with a thin white vaseline layer (epidermis and stomatal transpiration). Differences between leaves from the two areas are significant for epidermal transpiration, although nonsignificant between leaves with and without lesions; the loss of water by the lower leaf side shows significant differences between all three leaf groups.

2237 APTIC NUMBER 17978

Kerin, Z.
CONTAMINATION OF VEGETABLES BY THE EMISSIONS OF A LEAD REFINING PLANT. (Verunreinigungen von Gemuese aus Emissionen einer Bleihuette). Text in German. Qualitas Plant. Mater. Vegetabiles, vol. 15:372-379, July 10, 1968. 3 refs.

Harvest-ripe samples of vegetables (cichorium endivia, cichorium intybus, brassica oleracea, Sauerkraut, phaseolus vulgaris, parsley leaves and roots, potatoes, red beets, and carrots) were collected in various distances from a lead-refining plant in the years 1965 and 1966. The vegetable samples were analyzed in washed and unwashed states. The samples were dried and pulverized and mixed with nitric acid. A spectrophotometer was used for the determination. Contaminated unwashed cichorium endivia contained 19 to 104 ppm Pb (average 57 ppm Pb) while the control plants contained only 1.30 ppm Pb. In the washed state, the lead content ranged from 5.0 to 55.0 ppm in contaminated plants. In washed control plants, the lead concentration was 0.50 ppm. Similar high lead concentrations were found in all other vegetables from the contaminated area. Although a large fraction of the lead can be washed off the plants, a considerable amount still remains on the plants. Tuberous plants had lead concentrations of 10 to 50 times higher than tuberous control plants. This fact is important, because it is a consequence of the high lead contamination of the soil which will last for decades, despite the planned installation of filters. Likewise, restrictions of the addition of tetraethyl lead to automobile fuels will not erase the lead contamination of the soil along highways.

2238 APTIC NUMBER 20185

Kielstein, P.
INFLUENCE OF SOME TRACE ELEMENTS ON THE CAUSATIVE AGENTS AND THE COURSE OF DERMATOMYCOSES IN CATTLE. (Ueber den Einfluss einiger Spurenelemente auf die Dermatomykosen beim Rind und ihre Erreger). Dermatol. Wochschr., vol. 151:750-755, July 10, 1965. 4 refs. Translated from German. Franklin Inst. Research Labs., Philadelphia, Pa., Science Info. Services, 10p., Sept. 16, 1969.

The role of immunobiological and contributory factors in the development of bovine trichophytosis was investigated in a two-part study. In the first part, black cattle hair from 124 normal and diseased black-spotted lowland cattle was analyzed for iron, copper, manganese, and cobalt contents to determine the effect of the trace elements on the course of trichophytosis. Cattle with high iron levels in their hair tended to be affected less frequently and to develop milder symptoms at a later date than animals with low iron values. In vitro studies were next conducted on the effects of iron and copper on the growth of the fungus Trichophyton verrucosum, the most frequent causative agent of bovine trichophytosis. Traces of copper had no influence on oxygen consumption, but increasing concentrations (16-40 mcg/ml) significantly stimulated fungal growth. Concentrations of 240 mcg/ml and higher caused a statistically significant inhibition in the growth of Trichophyton mentagrophytes. Similar results were obtained in the studies of the effects of iron on oxygen consumption of the Trichophyton mentagrophytes. Although iron stimulated oxygen consumption in the first 72-96 hours of the experiment, oxygen consumption after 120 hours in media containing 50-200 mcg of iron/ml was equal to or lower than that of iron-free controls. At levels above 300 mcg, oxygen consumption was distinctly lower than in iron-free fungal suspensions. It is concluded that these elements are activators of fungal metabolism, with their fungistatic effects dependent on concentration and, in the case of iron, on time.

2239 APTIC NUMBER 20036

Lanz, Arthur and W. S. Stewart
STUDIES ON CHEMICALS TO PROTECT PLANTS FROM SMOG DAMAGE. Lasca Leaves, 13(2):46-47, Spring 1963. 4 refs.

Effective protection of Petunia from ozone-containing smog by spray application of 100 ppm of reduced glutathione, and by soil addition of cysteine is reported. Similar effects resulted in studies with carrot root cultures. Preliminary tests indicate that the sodium salt of ascorbic acid may be even more effective in counteracting smog damage.

2240 APTIC NUMBER 20028

LeBlanc, Fabius and D. N. Rao
REACTION OF SEVERAL LICHENS AND EPIPHYTIC MOSSES TO SULFUR DIOXIDE IN SUDBURY ONTARIO. (Reaction de quelques lichens et mousses epiphytiques a l'anhydride sulfureux dans la region de Sudbury, Ontario). Text in French. Bryologist, vol. 69:338-346, 1966. 11 refs.

Circular bark plugs 4.8 cm in diameter were cut from country roadside trees bearing 19 species of lichens and mosses, and forty-two plugs were transplanted in the summer of 1964 onto trees in Sudbury, Ontario, where the atmosphere is heavily polluted with sulfur dioxide. Most of the transplanted lichens and mosses were dead or greatly damaged in October of 1965. The lichens Bacidia chlorococca and Parmelia sulcata were the species most tolerant of the contaminated atmosphere. (Author abstract)

2241 APTIC NUMBER 20168

Leone, Ida A., Eleen Brennan, and Robert H. Daines
FACTORS INFLUENCING SO2 PHYTOTOXICITY IN NEW JERSEY. Plant Disease Reptr., 49(11):911-915, Nov. 1965. 19 refs.

Three conditions must be satisfied in order for air pollutants to exert phytotoxic effects: a pollution source; conditions of air stagnation conducive to the accumulation of the contaminant at ground level; and the presence of sensitive plants in the proper stage of growth. In the northeastern part of the country, a sulfur dioxide, largely a product of fuel combustion for heating purposes, is at a high concentration level from late fall to early spring. SO2 injury is not likely to occur, therefore, during the cold months, since the vegetation is either dormant or non-existent, or in summer, since the magnitude of SO2 pollution is too low. Conditions of air stagnation including frequent temperature inversions, low winds, high barometric pressure, and scant precipitation are particularly prevalent in the fall, and to a lesser degree in late spring. SO2 injury is not likely to be

observed in the fall, however, due to the absence of sensitive plant tissues and a lag in the rise of SO2 as a result of fuel burning. Thus, it is in late spring, particularly in May, that all three prerequisites for SO2 toxicity are present, which explains why SO2 injury to certain 'spring flowers,' young vegetable seedlings in cold frames, and newly emerged conifer needles is repeatedly observed during or immediately before or after the month of May. (Author summary)

2242 APTIC NUMBER 20770

Macdowall, F. D. H., L. S. Vickery, V. C. Runeckles, and Z. A. Patrick
OZONE DAMAGE TO TOBACCO IN CANADA. Can. J. Botany, 43(4):131-151, Dec. 1963. 22 refs.

Tobacco weather fleck has caused significant losses of flue-cured tobacco in southern Ontario since 1955. Fleck damage was greatest near the coast of Lake Erie and decreased progressively inland. Ozone has been shown to be one the most important incitants of the flect response in tobacco whereas parasitic fungi, bacteria, and viruses were proven not to be implicated as cause of the disorder. The inherently susceptible variety White Gold, used in all tests, was rendered more susceptible by irrigation and nitrogen deficiency. It was also more susceptible during flowering and when producing lateral shoots. The degree and duration of stomatal opening were important factors in determining the amount of injury. Concentration of ozone in the air affected the speed of fleck response as well as the severity of symptoms. A 6-hour fumigation with 45 ppha ozone in daylight damaged plants severely, but the same treatment in darkness was without effect. Statistically significant correlations between ozone concentrations and fleck damage were obtained from field data when the reponse of highly susceptible tissues only was considered. The merits of several visual rating methods are compared and discussed. (Author abstract modified)

2243 APTIC NUMBER 20237

Marten, G. C. and P. B. Hammond
LEAD UPTAKE BY BROMEGRASS FROM CONTAMINATED SOILS. Agron. J., 58(5):553-554, Sept.-Oct. 1966. 5 refs.

The possible absorption of concentrations of lead toxic to animals into the foliage of bromegrass growing in contaminated soils from specified sources was studied. Plants propagated from the same clone of bromegrass at an experimental farm were defoliated and transplanted to four soils in pots. The sandy-loam soils were from the surface, 25 m from a farm adjoining a battery smelter (680 ppm lead); the surface, 25 m from the bank of a well-traveled, 4-lane highway (59 ppm lead); from the normal greenhouse supply, (12 ppm lead); and a 25 m layer at a 150 m depth from a farm (95 ppm lead). Three crops were harvested from each pot. When the crops reached the heading stage (after 69 days) the first crop was harvested. The second crop was harvested after 73 days regrowth without heading. Chelates were added to the soils after the harvest of the second crop. The third crop was harvested at the heading stage after 37 days regrowth. Only the highly contaminated surface soil obtained from the smelter area (soil A) produced first-crop grass with significantly more lead than the control. No statistically significant differences appeared in the second crop, but there was a trend toward higher lead in soil A. The addition of chelates resulted in a distinct increase in lead concentration in grass growing in the two most contaminated soils. Trends toward greater lead uptake also appeared in the control and highway bank soils. Even the greatest lead grass concentration (34.5 ppm) was far below the level which would be toxic to animals consuming grass. At least 150 ppm lead in the total ration of dry matter is needed to approach levels to be toxic to cattle and horses.

2244 APTIC NUMBER 20234

McCallan, S. E. A., Albert Hartzell, and Frank Wilcoxon
HYDROGEN SULPHIDE INJURY TO PLANTS. Contrib. Boyce Thompson Inst., vol 7-8:189-197, 1935-1937. 14 refs.

A brief study was made of the toxic action of hydrogen sulfide gas on green plants; symptoms, species sensitivity, concentration of hydrogen sulfide, temperature, and similarity to lime sulfur injury were observed. The effect of hydrogen sulfide gas on 29 different species of green plants was studied. The plants were fumigated in glass chambers out-of-doors during the growing season; the compressed hydrogen sulfide gas was introduced into an air stream which was blown through the chamber. Young rapidly elongating tissue was characteristically more sensitive to hydrogen sulfide injury than older tissue. Typical symptoms are a scorching of the young shoots and leaves, basal and marginal scorching of next older leaves; mature leaves are unaffacted. The different species varied widely in their response. Temperature is as important as concentration; the injury increases rapidly with an increase in temperature. In some cases, wilted plants appear less sensitive to hydrogen sulfide injury than normal turgid plants. Plants tested for lime sulfur injury showed symptoms identical with those produced by hydrogen sulfide.

2245 APTIC NUMBER 17970

McNulty, I. B. and James L. Lords
POSSIBLE EXPLANATION OF FLUORIDE-INDUCED RESPIRATION IN CHLORELLA PYRENOIDOSA. Science, vol. 132:1553-1554, Nov. 25, 1960. 9 refs.

Increased oxygen uptake by Chlorella pyrenoidosa in the presence of sodium fluoride at various pH values was studied. NaF concentrations up to 0.000105M resulted in increased respiration as high as 60% above normal; above this concentration, oxygen consumption sharply dropped to below normal. A significant increase in phosphorylated nucleotides was found, suggesting that undissociated HF in the culture medium disrupts the basic energetic of the cell, thereby causing the increased oxygen uptake.

2246 APTIC NUMBER 20033

Menser, H. A. and O. E. Street
EFFECTS OF AIR POLLUTION, NITROGEN LEVELS, SUPPLEMENTAL IRRIGATION,

AND PLANT SPACIN[illegible] ON WE[illegible]THER FLECK AND LEAF LOSSES OF MARYLAND TOBACCO. Tobacco, 155(17):192-196, Oct. 26, 1962. 12 refs.

The interaction of air pollution (especially ozone) and nitrogen application rates (60-120 lb per acre), supplemental irrigation, and plant spacing (4840-9680 plants per acre) were studied in connection with the occurrence of weather fleck and premature leaf senescence and abscission in the Maryland tobacco variety Catterton. Leaf loss was significantly lower with higher nitrogen application rates without irrigation, and with increased plant population, indicating a relationship between plant sensitivity to ozone and other pollutants, and cultural conditions.

2247 APTIC NUMBER 20029

Menser, H. A.
RESEARCH NOTE NO. 1 RESPONSE TO OZONE OF FIVE-CURED TOBACCO VARIETIES. Tobacco, 162(9):32-33, 1966. 5 refs.

Greenhouse experiments were undertaken to determine the ozone resistance of the following varieties of flue-cured tobacco: White Gold, Delhi 61, N.C. 95, Hicks, and McNair. The cigar-wrapped varieties used for reference purposes included Bel-W3 and Bel-B which are, respectively, very sensitive and resistant to ozone fleck. In six experiments performed over a 10-day period, the plants were exposed to approximately 0.27 ppm ozone for two hours. Ozone fleck on flue-cured varieties resembled symptoms of damage Bel-B, with initial injury appearing as gray, water-soaked markings on the upper surface of mature leaves. These markings eventually became tan, or white, and sunken. No flue-cured plant was as susceptible to ozone as Bel-W3. White Gold was the most sensitive of the flue-cured varieties tested, but was damaged only slightly more than ozone-resistant Bel-B.

2248 APTIC NUMBER 20184

Menser, H. A., Tamara Sorokin, and Mary E. Engelhaupt
THE PIGMENTS, AMINO ACIDS, ALKALOIDS, GROWTH RATE, AND RESPONSE TO OZONE OF A CHLOROPHYLL-DEFICIENT MUTATION OF TABACCO. Tobacco, 160(7):27-32, Feb. 12, 1965. 15 refs.

Chemical analyses and various other measurements were performed on the progency of a dominant, chlorophyll-deficient mutation of tobacco (N. tabacum L.) The mutant was designated Su because of its sulfur-yellow appearance. Chlorophyll and carotenoid pigments of greenhouse Su mutant and normal leaves were extracted and examined in multipigment solutions in acetone. Total chlorophyll of mutuant plants averaged about 35% of the chlorophyll in normal plants. In mutant plants, chlorophyll content was higher in mature leaves than in young leaves; but in normal plants, this relation was reversed. The average total carotenoids, of mutant leaves were about 55% of the carotenoids of normal leaves. The chlorophyll a to b ratio was about 2 to 1 in leaves of all plants examined. The growth of Su mutant plants was severely inhibited when compared with normal growth. After 8 weeks, the average weight of normal plants was ten times greater than mutant plants. In the field, mutant plants did not develop a normal growth rate or normal pigmentation. Paper chromatography was used to analyze alkaloids, sugars, organic acids, and amino acids of Su mutant and normal plants. The mutant possessed certain similarities to plants grown under nutrient deficiencies. Compared with normal plants, mutant plants were lower in alkaloids and sugars and higher in free amino acids. Ozone fumigations revealed that mutant plants were highly resistant to ozone (0.50 ppm). Microscopic examination of leaves indicated that there were no apparent differences in stomatal behavior between Su mutant and normal plants that could account for differences in ozone susceptibility. (Author abstract modified)

2249 APTIC NUMBER 20167

Middleton, John T., J. B. Kendrick, Jr., and H. W. Schwalm
INJURY TO HERBACEOUS PLANTS BY SMOG OR AIR POLLUTION. Plant Disease Reptr., 34(9):245-252, Sept. 15, 1950. 6 refs.

The area where air pollution or smog causes plant damage in the south coastal basin of southern California extends from Santa Monica to San Clemente and inland to the Redlands. Meteorological and topographical features contributing to the smog problem in this area are briefly discussed. Air pollutants consist of three types of matter: gases, aerosols, and particulate substances. When the symptoms and lists of susceptible plants are compared, it is evident that established phytotoxic agents of air pollution, such as sulfur dioxide and fluorine, are not the primary constituents causing plant damage in the air pollution of this area. Since the initial injury in most cases is in the lower mesophyll of the leaf in close proximity to the stomata, it is supposed that the pollutants causing damage are either gases or substances that act like gases. The first visible symptoms arise on the lower surface of the leaf and are the result of the air spaces left by the collapse of the protoplasts in the mesophyll layer of cells. Leaves of crop plants which have little or no pubescence and a moderate amount of cuticle developed a shiny, glazed appearance. Pubsescent leaves having little or no cuticle appear somewhat bleached and lack the metallic luster. Later, these and adjacent tissues dry and the necrosis that develppes through to the top of the leaf leaves a scorched area. Occasionally the initial symptom develops on the exposed surface of the leaf, regardless of whether it is the top or the bottom side, and with no relation to the orientation of stomata. Many small necrotic spots without the associated glazing characterize this type of injury. Protected or shielded surfaces show no injury. This trouble develops only during periods of foggy weather and is attributed to a phytotoxic aerosol. As a result of a survey of eleven susceptible crops in 1949 in Los Angeles County, alone, it is estimated that the aggregate loss due to smog injury in that year was $479,495.00. The problem is serious enough to force several farming and nursery industries to move their operations to areas not affected by air pollution.

2250 APTIC NUMBER 17818

Mukammal, E. I.
OZONE AS A CAUSE OF TOBACCO INJURY. Agr. Meteorol. (Amsterdam), vol. 2:145-165, 1965. 7 refs.

The cause of severe tobacco crop damage from 'weather fleck' in

southwestern Ontario, Canada, were investigated at a site on the northern shore of Lake Erie. Data were collected with respect to meteorological and soil conditions, illumination, solar radiation, evapotranspiration, air stability, and ozone concentration. Weather fleck was caused by ozone, generated by photo-chemical processes from oxides of nitrogen and hydrocarbons emitted in industrial areas to the south. Thunderstorm activity and stratospheric ozone at times may also contribute to total ozone concentration in small quantities. Indications are that on most occasions of high ozone concentration, lake breeze surges and meso-scale systems forming as a result of the physiographical features of the Great Lakes area dominated the weather picture and were the key mechanism by which ozone was advected and brought down to surface. Severe flecking generally occurred with a particular combination of amounts of ozone dose and evapotranspiration. When the hourly ozone concentrations were modified by a coefficient of evapotranspiration derived from a simple form of the mass transfer equation, a much improved correlation between flecking severity and modified ozone dose was obtained, and several hitherto obscure results could be explained. Thus, severity of injury appears more dependent on the physiological and micrometeorological factors which determine the amount of downward flux of ozone in the lower layers for absorption by the plant than on the absolute magnitude of atmospheric ozone concentration. (Author summary modified)

2251 APTIC NUMBER 17977

Pajenkamp, H.
EFFECT OF CEMENT KILN DUST ON PLANTS AND ANIMALS. (Einwirkung des Zementofenstaubs auf Pflanzen und Tiere). Text in German. Zement-Kalk-Gips (Wiesbaden), 14(3):88-95, 1961. (Presented at the fall meeting of the Association of the German Cement Industry, Sept. 13, 1960, Salzburg.)

Various tests for determining the effect of cement kiln dust on plants and animals are reviewed. Cattle, sheep, and rabbits fed with fodder laden with dust from a nearby cement kiln for 60 days showed no effects. Each animal received between 2.5 and 11 g cement kiln dust per day. In a second series of experiments, the daily consumption of dust was increased to 33 g. But again, no clinical symptoms were observed. At the end of several other experiments, it was concluded that this kind of dust has no pathological effect on animals. Field experiments conducted in 1958/1959 by the Agricultural Chemical Institue, Goettingen with clover, oats, beets, and darnel also showed no direct influence of the cement kiln dust on the growth of these plants. An average quantity of 0.75 g of dust was strewn over the plants per square meter per day. The dust contained 29.3% CaO and 3.1% K2O. The alkaline components of the dust raised the pH of the soil. It is recommended to fertilize such soils with an acid fertilizer.

2252 APTIC NUMBER 20062

Schuck, E. A. and J. K. Locke
RELATIONSHIP OF AUTOMOTIVE LEAD PARTICULATES TO CERTAIN CONSUMER CROPS. Environ. Sci. Technol., 4(4):324-330, April 1970. 8 refs. (Presented at the Symposium on Air Conservation and Lead, Division of Water, Air, and Waste Chemistry, 157th National Meeting, American Chemical Society, Minneapolis, Minn., April 1969.)

The colorimetric dithizone technique was used to analyze cauliflower, tomatoes, cabbage, strawberries, and valencia oranges for their lead content. The soil, water, and air in contact with the crops were also analyzed for lead. The combined findings from the edible portion of four of the five crops strongly suggest that automotive lead particulates are not absorbed. They exist rather as a topical dust coating of which at least 50% can be removed by simple water washing. Neither did these crops show any inclination to absorb lead through their root systems. Similar conclusions relative to strawberries cannot be drawn, except by analogy to the other crops. In spite of growing near heavily traveled highways, i.e., up to 50,000 vehicles a day, the amount of lead associated with the five crops in an untreated state was never greater than one microgram of Pb per gram of fresh weight. The average Pb concentration of the entire crop areas studied was one or two orders of magnitude less than one microgram of Pb per gram of fresh weight. (Author abstract modified)

2253 APTIC NUMBER 20146

Shoemyen, Janos
OZONE, SOIL MOISTURE, MATURITY LEVEL: INTERACTION CAUSES WEATHER FLECK ON SHADE TOBACCO. Sunshine State Agr. Res. Rept., 1967: p. 8-9, May 1967.

Severe episodes of ozone-induced weather fleck in 1965 and 1966 caused heavy damage to Florida shade-grown tobacco corps. Ozone had previously been identified as the cause of this leaf malady, and damaging concentrations were attributed to the photochemical action of ultraviolet light on hydrocarbons from industrial and automotive emission sources in surrounding metropolitan areas. Studies of injured leaves showed that fleck occurred 24 to 36 hours after the initial rise in ozone levels. Only leaves at certain positions on the stalk or at certain maturity levels were damaged; both immature and over-mature leaves escaped damage. The extent of fleck damage on plants receiving different rates of supplemental irrigation showed that heavily watered plots were much more prone to fleck damage, although the reasons for this effect are not yet fully understood.

2254 APTIC NUMBER 20015

Spencer, G. R., E. C. Stone, and D. F. Adams
FLUORIDES IN ANIMALS IN THE DALLESPORT AREA. Wash - State Univ. Agr. Exp. St., St. Circ., no. 353, 8p. 1959. 2 refs.

The natural levels of fluoride intake, storage, and excretion were determined in farm animals in the area of a new aluminia reduction factory, prior to start-up of the plant. In addition, the local prevalence of other diseases that might be confused with fluorosis were to be established. Animals and feeds in the Dallesport, Washington area of Klickitat Country and The Dalles, Oregon area had a normal fluoride level. Water from 13 ranches had from 0.05 to 1.26 ppm fluoride with a mean of 0.25. Hay from twelve ranches had from 0 to 8.3 ppm fluoride with a mean of 4.4. Analyses of urine, horn, hoof, teeth, and bone from cattle

(mostly beef) disclosed normal levels of excretion and storage. Physical examination of cattle on 11 ranches disclosed normal teeth in most individuals and only one case of lameness. It was concluded that no unusual or abnormally high sources of fluoride are available to the animals in the area. (Author summary modified)

2255 APTIC NUMBER 20157

Van Brackle, Richard D.
THE FARMER'S STAKE IN AIR POLLUTION. Crop Soils Mag., 20(1):17-19, Oct. 1967.

The assessment of agricultural problems caused by air pollution is difficult, since air pollution injury is not easily distinguishable from insect or disease injury; pollution makes crops more susceptible to insects and disease; and some pollutants cause damage at very low concentrations and may not be suspected. The $15 million of visible damage done to crops in California does not include such factors as reduced vigor, longer growing season, extra water and fertilizer, and lowered quality. Photochemical air pollution is considered the most dangerous type for agriculture. More than 300 types of plants are affected by air pollution. the average California automobile is 5 1/2 years old, has had two owners, is driven approximately 9,000 miles per year and makes about one 25-mile trip per day; this results in a daily emission of 6 1/2 pounds of contaminants, which in turn results in a total figure for 1963 of 56 million pounds. Among the major pollutants that damage plant life are ozone, peroxyacetyl nitrate various types of fluorides, sulfur dioxide, and ethylene. Air pollution has had an adverse effect on agriculture for over a century.

2256 APTIC NUMBER 20158

Zimmerman, P. W.
CHEMICALS INVOLVED IN AIR POLLUTION AND THEIR EFFECTS UPON VEGETATION. Proc. Governor's Conf. Exhibit Atmospheric Pollution, New Jersey, 1952, p. 23-31. 33 refs. (Feb. 19-20.)

Results of studies on the effects of various gases on plants are summarized for sulfur dioxide, hydrogen fluoride, chlorine, hydrogen sulfide, ammonia, mercury vapor, ethylene and carbon monoxide, and the vapors of 2,4-D and other hormone-type chemicals. Measurements of the atmosphere at Yonkers, New York, show an average of 0.01 ppm of SO2 for 62% of the year. A maximum concentration of 0.75 ppm occurred in January. Leaves of alfalfa and buckwheat exposed to a concentration of 0.40 ppm for 7 hours became spotted. Working with concentrations of 0.1-0.2 ppm of SO2, the following observations were made: there is more SO2 resistance at or below 40 F, and SO2 sensitivity does not change with minor variations in soil moisture. The sulfate content of the nutrient supply did not affect sensitivity, although the growth rate of sulfur-defficient plants increased under fumigation with 0.1-0.2 ppm SO2. Plants recover between treatments if these are sufficiently spaced. Sensitivity was not affected by wetting the leaf surface. Young plants are more resistant than old plants; older leaves are more resistant than younger ones. HF gas tends to injure the margin of the leaf more frequently than SO2. Application of sodium fluoride to soil caused similar injuries to those induced by HF fumigation H2S gas is less toxic than the other gases tested, and injured the younger rather than the older leaves. Substituted phenoxy acids are extremely selective, stimulating growth in some plants and injuring or deforming others.

# EFFECTS – MATERIALS

2257 APTIC NUMBER 20074

Deswaef, R.
DETERMINATION OF MICROCLIMATES IN TERMS OF ATMOSPHERIC CORROSION FACTORS. ATMOSPHERIC CORROSION OF ZINC. (Determination de microclimats en tant que facteurs de corrosion atmospherique. Cas de la corrosion atmospherique du zinc). Text in French. Tribune Cebedeau Etude Doc. Eaux), 23(314):24-28, Jan. 1970.

Zinc samples were exposed at 4 sites of the National Center of Metallurgical Studies, Belgium, and data on the formation and destruction of the protective coating of the zinc was correlated with meteorological data supplied by the Royal Meteorological Institute, the Institute of Astrophysics, and the engineering department of the Eupen Dam. Exposures were made during the last two weeks of June and the last two weeks of December, 1968. Environmental factors considered in the study were atmospheric humidity, atmospheric precipitation, frequency and strength of wind, concentrations of sulfur dioxide, carbon dioxide, hydrogen sulfide, and chlorides in the air, and the weight, granulometry, morphology, and spectrometric analysis of dust particles. A twofold analysis of SO2 was made by the relative, cumulative method of Liesegang-Leclerc and by the absolute, instantaneous method of Stratmann. The former was most suitable for the purposes of this study. Morphological study of atmospheric dust collected at Ostende indicated the influence of topography (grains of sand) and of home heating (soot). The samples studied at Eupen indicate that home heating is the only source of pollution in that area, while at Liege, the local steel plants play an important role.

2258 APTIC NUMBER 20107

Fujikawa, Fukujiro, Kunio Hirai, Teruhisa Hirayama, Mitsuo Fujii, Yutaka Tsujide, Mamoru Shibata, Hideko Toyoshima, Kazue Suzuki, Matsuyo Tsuda, Hiroshi Yamada, Masanori Sawatari, Jiro Takimoto, Hiroshi Kawaguchi, Yukichi Matsuyama, Junichi Ueda, Teiji Matsutori, Masaaki Kadoma, Katsuji Okazaki, Hiroshi Nakamura, Yasuo Mantani, and Nobuo Takeda
THE INFLUENCES OF AIR POLLUTION OF SOME CULTURAL ASSETS. II. THE INFLUENCE OF AIR POLLUTION UPON THE DYED CLOTHS. (Taikiosen niyoru bunkazai nitaisuru eikyo (dai 2 ho). Taikiosen ga senshoku butsu eoyobosu eikyo). Text in Japanese. Eisei Kagaku (J. Hyg. Chem.), 16(2):96-100, 1970. 6 refs.

Two kinds of dyed cloth were exposed to air and then examined for the effects of atmospheric pollutants. One cloth was a silk dyed with benzo-purpurine 4B, which is especially sensitive to sulfur dioxide. The second was a rayon fabric dyed with diacelliton-fast brilliant blue B, which is especially sensitive to nitrogen dioxide. The color of the cloths was measured by a spectrophotometer before and after exposures for 30 days. A comparison of the measured values before and after exposure indicates that the present degree of pollution by sulfur dioxide and nitrogen dioxide is sufficient to affect the color of dyed cloths.

2259 APTIC NUMBER 20159

AIR POLLUTION AND CORROSION. IMPORTANT NEW TESTS SHOW CLOSE CORRELATION. Smokeless Air, (London), vol. 84:75-76, 1952.

At 16 sites in Great Britain (equally divided among the 4 classifications of slight, moderate, heavy, and severe exposure to pollution), two zinc and two copper-steel specimens were exposed for one year alongside instruments for the detection and measurement of sulfur dioxide which was performed on a monthly basis. The averages of the 12 SO2 determinations were compared with the losses in weight of the zinc and steel specimens. The Spearman correlation coefficients were as high as 0.98 for copper-steel and 0.97 for zinc.

# STANDARDS AND CRITERIA

2264 APTIC NUMBER 20861

Henderson, J. S.
PLANNING FOR AIR POLLUTION CONTROL. PART 1- LAWS AND THEIR IMPACT. Plant Eng., 24(12):94-97, June 11, 1970.

The Clean Air Act of 1967 designates 91 air quality control regions and makes each state responsible for adopting regional air quality standards and for developing an abatement procedure plan. The central cities of the air quality control regions are specified in this article, and the need of control agencies to include emission standards in their implementation plan is discussed. Typical standards for particulate emissions from coal-fired boilers, manufacturing processes, and incineration are summarized, as are representative ambient air standards for particulates and sulfur dioxide. Some state and local laws require all emission sources to meet both pollution emission and plume visibility standards. Plant engineers may also face compliance with other types of requirements and restrictions. These may include industrial source registration, including quantities and location of pollutant discharges; registration of plant expansions or process changes; plant access and inspection by control authorities; provision of stack sampling ports and platforms, and continuous monitoring of stack discharges.

2265 APTIC NUMBER 17988

New York State Air Pollution Control Board, Albany, Council of Technical Advisors
CURRENT GUIDES FOR PREVENTION OF NEW AIR POLLUTION. 8p., Jan. 1962.

Guidelines are given for determining the necessity of pollution control and for achieving the desired control, where needed, in a reasonable and practical manner. Air pollutants are classified in a series of categories A-F, in terms of their effects on humans, animals, vegetation, and property. Process and combustion operations are classified according to their average emission rate potential and the minimum desired air cleaning; the latter is expressed as a range of the average overall air-cleaning efficiency by weight percent. The emission rate is plotted as a function of emission rate potential and air contaminant class (A-F). Methods of control include process control, control by atmospheric dispersion and dilution, and by gas treatment.

2266 APTIC NUMBER 20218

Ordynskiy, L. L.
VITAL STAINING AS A RAPID METHOD OF DETERMINING APPROXIMATE MAXIMUM PERMISSIBLE CONCENTRATIONS. (Metod vital 'nogo okrashivaniya, kak ekspressmetod pri opredelenii oriyentirogochnykh pdk). Text in Russian. Toksikol. Novykh Prom. Khim. Veshchestv., no. 9:37-43, 1967. 24 refs.

Maximum absorption of stains occurs upon loss of muscular contractility and at the moment of maximum toxicity. Data on vital staining of rat liver after poisoning with carbon tetrachloride, toluene-2,4-diisocyancite, and nitrogen dioxide are presented. It is concluded that the threshold of paranecrosis immediately after poisoning can be precisely determined by this method. The threshold of paranecrosis thus detected is close to the maximum permissible concentration for the substances tested; however, this method may not be considered universal.

2267 APTIC NUMBER 20199

CALIFORNIA AIR RESOURCES BOARD ADOPTS TIGHT EMISSION STANDARDS FOR 1975 CARS SOLD IN CALIFORNIA. S. A. E. (Soc. Automot. Engrs.) J., 78(3):28-32, March 1970. 6 refs.

The 23 g/mile of carbon monoxide allowed for 1974 cars must be drastically reduced to return the Los Angeles atmosphere to its 1940 quality. Some lowering of the nitrogen oxides level below the 1974 requirement of 1.5 g/mile should also be considered. In addition, further lowering of unburned hydrocarbons below the 1.5 g/mile allowed for 1974 vehicles is necessary. Exhaust manifold reactor systems using air injection and exhaust gas recycling systems represent two approaches to achieving lower emission rates. Manifold reactors reduce hydrocarbon emissions below 50 ppm and carbon monoxide to 0.5%. Exhaust recycling systems appear capable of reducing nitrogen oxides by 75-90%. However, a test car equipped with a series of manifold reactors and exhaust gas recycle system had some loss in driveability, a 5-10% lower fuel economy, and an approximately 8% loss in maximum power. Both gas turbines and rotary engines show good potential as alternatives to gasoline engines. Natural gas is the most promising as an alternative fuel from the standpoint of simple utilization, availability, and minimum loss of performance and economy.

2268 APTIC NUMBER 20121

RECOMMENDATIONS OF PERMISSIBLE CRITERIA OF HAZARDOUS WORKING ENVIRONMENTS BY JAPAN ASSOCIATION OF INDUSTRIAL HEALTH. 1969. Sangyo Igaku (Jap. J. Ind. Health), 12(2):37-44, Feb. 20, 1970. 15 refs.

The Japanese Association of Industrial Health annually recommends permissible concentrations of toxic gases, vapors, mist, and fumes in the working environment. The 1969 limit values for 86 toxic substances are shown in ppm and/or mg/cu m. Like the Threshold Limit Values established by the American Conference of Governmental Industrial Hygienists (ACGH), the concentrations are time-weighted average concentrations for an eight-hour working day. The table cannot be applied to works where exposure to toxic substances is extremely irregular or short-term. The limit values for butyl acetate, buty alcohol, carbon monoxide, p-dichlorobenzene, ethylene glycol dinitrate, nitrobenzene, hexane, selenium compounds, lead, nitric acid, styrene monomor, toluene, 1,1,1-trichloroethane, and trichloroethylene differ from those of the ACGH. Factors affecting the Japanese decision are discussed in the case of hexane, lead, styrene monomor, and toluene. The article also reviews permissible criteria for noise exposure, thermal standards for high-temperature work, and permissible dust concentrations.

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2269 APTIC NUMBER 20221

Shalamberidze, O. P.
LIMITS OF ALLOWABLE CONCENTRATION OF LEAD SULFIDE IN ATMOSPHERIC AIR. In: Limits of Allowable Concentrations of Atmospheric Pollutants. V. A. Ryazanov (ed.), Book 5, Washington, D. C., U. S. Public Health Service, March 1962, p. 29-38. 12 refs. (Translated by B. S. Levine.)

Limits of allowable lead sulfide concentrations were developed on the basis of determinations of actual concentrations present in the air around a lead ore concentrating plant and studies of the effect of exposure to lead sulfide in laboratory animals. The concentrations of lead ranged from 18.8 micrograms/cu m at a distance of 250 meters to 1.3 micrograms/cu m at 500 meters; the concentrations of lead-containing dust, from 1.24 micrograms/cu m at 250 meters to 0.69 micrograms/cu m at 500 meters. Distribution of the lead sulfide was found to be influenced by wind velocity and direction, as well as by atmospheric precipitation Analysis of lead ore concentrate dust showed that its toxic component was PbS. Rats exposed to 48.3 micrograms/cu m of ore dust six hours daily for six months exhibited conditioned reflex shifts, which differed with the typological characteristics of the rat's higher nervous activity pattern. No shifts in higher nervous activity were observed in rats exposed to 13.5 micrograms/cu m of lead sulfide. Brain tissues of exposed rats showed the presence of dystrophic changes in isolated ganglia cells. No changes attributable to lead poisoning were seen in internal organs or blood. It is suggested that the allowable 24-hr concentration of lead sulfide be set at 1.7 micrograms/cu m and that the lead ore concentration plant be surrounded by a sanitary clearance zone not less than 500 meters wide.

2270 APTIC NUMBER 12261

Ministry of Health and Welfare Tokyo (Japan), Environmental Pollution Control Section
BACKGROUND FOR NUMERICAL CONDITIONS OF THE AMBIENT AIR QUALITY STANDARD FOR SULFUR OXIDES. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), pagination not given. 1968 (?). Translated from Japanese. 20p.

A close correlation exists between the number of days/year and the number of hours/year in which the legal threshold concentrations (0.05 ppm and 0.1 ppm respectively) are not exceeded. The number of people with symptoms of chronic bronchitis is twice as high in areas where the above limits are exceeded as compared to non-polluted areas. Measurements were conducted in Tokyo, Osaka, Yokkaichi, and at other points; the probability that the hourly values of 0.1 ppm is not exceeded was 93%. The probability that the daily mean value of 0.05 ppm is not exceeded was 80%. This holds when the yearly value is set at 0.05 ppm. If the yearly mean value is set at 0.04 ppm, the probabilities are 86% in the first case and 70% in the second case. According to the enforcement regulations for smoke, alert conditions begin at 0.2 ppm. If the probability that the hourly value of 0.1 ppm is not exceeded is assumed to be higher than 88 to 93% and the probability that the daily mean value of 0.05 ppm is not exceeded is assumed to be 70 to 80%, alert conditions will prevail more than 11 times a year, or on more than 3% of the days/year. The probability that the hourly value of 0.2 ppm is not exceeded must therefore be 99%.

# LEGAL AND ADMINISTRATIVE

2271 APTIC NUMBER 20219

Barth, D. S.
PUBLIC HEALTH ASPECTS OF AIR POLLUTION. Preprint, American Medical Association, 7p., 1969. 4 refs. (Presented at the Symposium and Panel on Chronic Pulmonary Insufficiency and Problems of Air Pollution, New York, N. Y., July 16, 1969.)

A discussion of the role of the Federal Government in implementing the Air Quality Act by the designation of Air Quality Control Regions and the issuance of Criteria and Control Techniques Documents for major pollutants is followed by a review of the major problems of research to identify the effects of pollutants on health. The problems are (1) to determine long term effects of low levels of air pollutants, singly or in combination; (2) to identify individuals most sensitive to pollutants; (3) to develop a health surveillance network capable of monitoring the potential effects of pollutants; (4) to define a health hazard index; (5) to identify additional environmental factors that interact with pollutants; and (6) to identify indicators in humans of effects which occur before long-term deleterious effects become apparent.

2272 APTIC NUMBER 20810

Brazell, J. H.
METEOROLOGY AND THE CLEAN AIR ACT. Nature (London), 226(5247):694-696, May 23, 1970. 11 refs.

Following the London fog of December 1952, the campaign for smoke abatement was intensified and the Committee on Air Pollution was set up. The Clean Air Act was passed in 1956 and gave local authorities powers to establish smoke control regions. As indicated by studies of fog frequency at airports in London, Manchester, Yorkshire, and Glasgow, there has been a steady improvement in visibility within the last decade at both urban and rural sites. Reduction in the frequency and intensity of fog in some 'black areas' has been dramatic, while there has been an outstanding increase in winter sunshine in central London. There is little doubt that these improvements are associated with the continued spread of smoke control measures under the Clean Air Act.

2273 APTIC NUMBER 20831

STATE REGULATIONS. Chem. Eng., 77(9):23-36, April 27, 1970.

A summary of basic state laws pertaining to air- and water-pollution control is presented as a quick means of checking pollution codes. Agency powers are noted, as are provisions made for penalties, tax relief, and assistance to those planning control programs. State offices from which further information can be obtained are indicated.

2274 APTIC NUMBER 11853

Hashimoto, Yichio
AIR POLLUTION AND AIR MANAGEMENT. PRESENT STATUS IN JAPAN. Ministry of Health and Welfare, Tokyo (Japan), Environmental Pollution Control Section, 8p., 1968 (?).

Government response to the ever increasing air pollution problem in Japan is reviewed. Requirements for air management research are outlined with specific attention given to measurement, analysis of processes relating emissions to observed ambient pollution levels, effects of exposure to specific pollutants, and research related to emission control systems. The need for both interministerial cooperation within the country and international cooperation with other countries is stressed.

2275 APTIC NUMBER 20133

Ireland, F. E. and D. H. A. Price
INCINERATION: STATUTORY REQUIREMENTS AND ENVIRONMENTAL ASPECTS. J. Inst. Fuel (London), vol. 43:115-119, April 1970.

Statutes concerned with airborne effluents and liquid wastes from incinerators are stated, and some brief notes are given on the more important requirements and their fields of application. Emissions of smoke from incinerators must not be as dark as or darker than shade 2 on the Ringelmann Chart; any practicable means must be used to minimize the emission of grit and dust (the Clean Air Acts of 1956 and 1968). The Works Regulation Act (1906) is administered by inspectors of the central authority to control emissions from works for the destruction by burning of wastes produced in the course of organic chemical reactions and works in which metal is recovered from scrap cable by burning the insulation. The Radioactive Substances Act (1960) deals with the disposal of radioactive waste. Chimney height determination is an extremely important aspect of incinerator design, while the three most important facets to minimize air pollutants from municipal incinerators are efficient combustion, arrestment of particulate matter, and height of dispersion. Waste water may be discarded to the sewer of the Local Authority, to an inland water course or estuary, to the sea, or soaked away on land. The various controlling bodies are empowered to stipulate conditions regarding the volume, composition, and the characteristics of the discharge. Strongly acidic or alkaline waters may be troublesome, and upper and lower limits for pH are usually imposed. A maximum permissible temperature is also often stipulated. A Local Authority controls discharge to sewers, and the River Authority controls discharges to inland and tidal waters.

2276 APTIC NUMBER 17940

Kester, Bruce E.
AIR POLLUTION-RULE AND REGULATION. Preprint, Inst. of Electrical and Electronics Engineers, New York, 10p., 1968. 3 refs. (Presented at the IEEE (Institute of Electrical and Electronics Engineers) Cement Industry Technical Conference, St. Louis, Mo., May 21-24, 1968.)

The history of air pollution with respect to the cement industry

is briefly reviewed from the early 1900's when pollution control was nonexistent and cement plants were generally far from populated areas, through world War II with vastly increased pollution levels, to the present situation of great public awareness and stringent control regulations. The application of process weight tables to dust emissions from cement plants presents many specific questions of interpretation which remain to be clarified. A comparison analysis is presented, showing the wide range of basic design criteria submitted by different manufacturers of electrostatic precipitators to handle one process and to meet the same efficiency. In addition, the daily efficiency of a cement kiln precipitator often is markedly lower than that determined during the acceptance test, and unless a dust collection system is designed with excess capacity anticipated, trouble develops as soon as production rates increase. More precise definitions, better test procedures, and agreement on basic design criteria are urgently needed.

2277 APTIC NUMBER 12269

Southern California Univ., Los Angeles, School of Public Administration and Michigan Univ., Ann Arbor, Environmental Simulation Lab.
APEX: A GAMING SIMULATION FOR AIR POLLUTION EXPERIENCE IN A SIMULATED METROPOLITAN ENVIRONMENT. APEX REPORT NO. 1 - CONCEPTUAL DESIGN. 114p., Dec. 1968.

The initial development of a special-gaming situation designed to acquaint air pollution professionals with the critical interdependencies between the air quality and the complex natural and social environment of a metropolitan area is described. The gaming simulation proposed includes specific efforts to meet some of the limitations of urban and metropolitan gaming simulations. These are the problems of creating a reasonable level of reality for complex urban phenomena, the difficulties of modeling key phenomena in urban areas, and time constraints which limit possibilities for realizing all potentials, such as the use of analytical tools and programming and planning techniques, as well as inter-role and inter-group bargaining interactions. One of the major aims of the program is to show students the potentials and limitations of an air pollution control program which must compete with many other problems and issues for the attention of decision makers as well as for scarce resources. Rather than dealing with the technical knowledge and skills required for air pollution control or with the details of administrative operations, the gaming situation concentrates on the large metropolitan context within which air pollution control problems must be resolved. Detailed descriptions are included of the intended development of the simulated metropolitan environment, the gamed decision roles, the gamed problems and issues, interactions among roles and with computer simulations, student preparation, support materials, and the proposed data system.

2278 APTIC NUMBER 18179

PROVINCE BY PROVINCE - HERE'S CANADA'S JUNGLE OF POLLUTION CONTROL. Mod. Power Eng., 63(6):68-69, June 1969.

A table showing Provincial legislation on water and air pollution is presented. Each province operates under its own chosen air pollution legislation including the Public Health Act, the Clean Environment Act, the Health Act, and the Air Pollution Control Act, but few provinces have the knowledge or personnel to carry out a successful campaign against pollution. Plant engineers are urged to contact the governing body listed for the province where the plant is to be located, abide by those standards, and adapt a self-monitoring policy.

2279 APTIC NUMBER 17916

Perman, Robert
EMERGING CONCEPTS OF AIR POLLUTION PROBLEMS, AS SEEN BY THE POLITICAL SCIENTIST. J. Air Pollution Control Assoc., 16(10): 532-535, Oct. 1966. 6 refs.

The political scientist's specialized approach to the problems posed by air pollution has developed in several directions. Until recently, his principal interests were those of the metropolitan area-governmental unit complex, federal-state-local relationships, and the clash of factions and pressure groups in a pluralistic society. While these are still of importance and of interest, there is now emerging a viewpoint of air pollution as a problem associated with current political emphasis on improving the quality of American life, in a society that reached a new plateau after dealing primarily with such quantitive matters as economic security and full employment. There is also emerging an increased interest in application of economic yardsticks, such as cost-benefit ratio analysis, and in developing the economic motivation factor as elements in guiding political and administrative directions in control activity. The political scientist is especially interested in the issue whether there is to be an assumption of public responsibilty through tax benefits to an individual polluter or whether each polluter should bear the cost of preventing pollution. One might reasonably anticipate that the political philosophy student would delve deeply into the value-loaded, perhaps ethical, issue of whether the public should permit a freedom to pollute the air depending on the willingness or unwillingness of the polluter to bear the appropriate charges.

2280 APTIC NUMBER 17927

Thayer, J. M.
THE CONTROL OF GRIT, DUST, AND FUME EMISSIONS FROM INDUSTRIAL PROCESSES. Conf. Filtration Soc., Dust Control Air Cleaning Exhibition, London, 1969, p. 10-15. 8 refs. (Sept. 23-25.)

Atmospheric pollution from industrial sources in England and Wales are controlled in part by the Clean Air Acts of 1956 and 1968 and the Alkali Act of 1906. The 1956 Clean Air Act prescribes standards for the emission of smoke from chimneys and prohibits smoke darker than Ringelmann 2, except for certain specified periods. The 1968 Act adds to this by prohibiting the emission of dark smoke from industrial and trade premises as distinct from chimneys. The 1956 Act deals with dust and soot only in general terms. The 1968 Act, covering emissions of grit and dust from furnaces, applies to a wide range of furnaces burning solid, liquid, or gaseous matter, excluding small domestic boilers. The recommended standards for furnaces

burning fuel equivalent to 100 to 50,000 lb per hour of coal are illustrated graphically. Recommendations are also offered for reducing grit and dust emissions from cold blast cupolas at iron foundries. These involve minimizing emissions by suitable arrestors fitted at the top of the shaft or dispersing fumes from chimneys not less than 120-ft high. The Alkali Act is a measure to control emissions from virtually all the heavy chemical industries, the fine chemical industry, petroleum refining, and petro-chemicals, nonferrous metallurgy, iron and steel production, power stations, coke and gas works, and certain ceramic and lime works. The Act provides for the establishment of grit, dust, and fume emission standards and requires suitable equipment for obtaining these standards. Arrestment to a specific standard by dispersal of waste gases at inadequate height is given in some detail for cement works, iron and steel works, lead works, and electricity works.

# GENERAL AND MISCELLANEOUS

2281 APTIC NUMBER 17619

Edison Electric Inst., New York
THE YEAR 2000: AN EEI STAFF STUDY. 44p., Aug. 1967.

Based on consultations with scientists, architects, urban planners, demographers, sociologists, and others, a composite picture of life in the United States is projected for the year 2000. All categories of air travel are expected to increase, although the use of private planes will be closely regulated by the government. The demand for jet fuel will nearly double, and new oil refining technologies will be needed to meet the demand. Alternative fuel possibilities, such as hydrogen or nuclear, may be feasible eventually but do not seem possible by 2000. Mass transit systems will link residential and business areas with regional airports, with conventional steel-wheel, steel-rail systems increasingly replaced by vehicles propelled by air cushions. Two major types of electrically-powered vehicles will probably be in use: the small, fleet-operated electric car for use in recreation areas, parks, or downtown shopping areas; and vehicles that will be able to operate on and off a powered roadway. Family-size electric cars will capture an increasing share of the car market. New electric batteries promise to make electric cars and trucks competitive with their gasoline-powered counterparts. There will be increasing associations of compatabile, coexistant land uses. An area which has a wide range of recreational possibilities may also be managed for forestry, wildlife, flood control, power generation and transmission, and even urban settlement. Buildings will alter their use, from residence to office space, with the needs of the community: multiple-use buildings will be common. Temporary structures such as geodesic domes and inflated balloons will add great flexibility to the design of cities. Downtown shopping areas will be enclosed and completely climate controlled. Small domes over patios, golf courses, and swimming pools also seem probable. Increased control of the climate in individual homes will be evident. Units will be available that will cool the air while cleaning and purifying it, temper the humidity, heat it in winter, control odors, and even regulate ion charge.

2282 APTIC NUMBER 18177

Gerber, Abraham, and Bruce C. Netschert
THE ENERGY OUTLOOK FOR THE UNITED STATES. IEEE (Inst. Elec. Electron. Engrs.) Spectrum, 6(6):38-45, June 1969. 6 refs.

Prevailing trends in U. S. energy production and consumption are reported, and statements are made concerning the outlook for the future. Total energy consumption in the U. S. grew at an average rate of 4.3% in the period of 1961-1966. Rate of growth for consumption of fuels for the production of electricity was 7.3%. Fossil fuels are to continue to be the main source of fuel for electricity with an increase of 3.1%/yr. in the rate of consumption. Nuclear fuel is beginning to emerge as a competitor of fossil fuels, but it is not possible to predict its likely impact on the consumption of fossil fuels in the next two decades. Sources of all fuel types are discussed. Air pollution resulting from energy production is discussed. One of the most important issues is industrial SO2 emission, and the legislation dealing with this emission. Control by desulfurization of fuels, higher stacks, and removal of SO2 from flue gases is discussed. The impact of measures to abate air pollution on energy consumption in the near future cannot yet be forseen.

2283 APTIC NUMBER 20040

Middleton, John T.
AIR POLLUTION THREAT TO FLORA AND FAUNA DOUBLES THREAT TO MAN. Conserv. Catalyst, 2(2):1-3, 1966.

Effect of air pollution on humans, animals, and vegetation in the United States and Canada are reviewed. Pollutants touched on are sulfur dioxide, sulfur, nitrogen dioxide, fluoride, ozone, and peroxyacyl nitrate. Pollution control efforts since passage of the 1963 Clean Air Act, and implications of the 1967 Air Quality Act, are discussed.

2284 APTIC NUMBER 20859

O'Sullivan, Dermot A.
AIR POLLUTION. Chem. Eng. News, 48(24):37-41, 45-46, 50, 54-55, 57-58, June 8, 1970.

Various aspects of air pollution from its sources to the costs of control are discussed. The pollutants originate from industrial processes, paper and pulp operations, petroleum refineries, and chemical plants; from garbage dumping, trash incineration, and agricultural burning; from power generation and space heating; and from automobiles, trucks, and aircraft. The chemical reactions that produce photochemical smog are reviewed. Weather conditions that prevail at any particular time and the topography of an area have a marked influence on the effects of pollution. A number of airborne pollutants, such as carbon monoxide, sulfur dioxide, nitrogen oxides, ozone, and polynuclear hydrocarbons, have been studied to determine their effects on health. Air pollution levels are linked to higher death rates from coronary heart disease and stroke; airborne asbestos particles may lead to lung cancer, mesothelioma, and cancer of the peritoneum or pleura. The effects of pollutants on crops and plant life are assessed. Accurate monitoring is needed to control pollutants and to set the standards to limit their concentrations in the air. Auto emission reduction methods are discussed, as well as the costs for pollution control.

2285 APTIC NUMBER 20241

Thomas, Moyer D.
AIR POLLUTION REVIEW 1954-1955. Ind. Eng. Chem., 48(9):4522-4527, Sept. 1956. 96 refs.

The initial ACS review of current air pollution literature was published in 1954. This second review covers 1954 and 1955 with a few references to earlier and later works. In this two-year period, many symposia have been held, the individual papers of which generally represent new research not previously discussed

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or published. The 1954 and 1955 ACS Air Pollution Symposia were devoted to analytical, biological, and engineering aspects of air pollution, and also to the chemical reactions of pollutants in the atmosphere. The Third National Air Pollution Symposium in April 1955 had 29 papers covering a wide range of subjects, including many different analytical methods for aerosols and gases and their application to the measurement of air pollution in Los Angeles and other cities, the effects of air pollution on plants, health considerations, and legal problems. Brief comments on some of the papers presented are given.

# SUBJECT INDEX

The terms listed in this subject index are those that most closely describe the information presented in the abstracts. Instead of the APTIC number, the NAPCA ABSTRACT BULLETIN (NAB) number is used to identify the abstracts. The NAB number is shown in the upper left corner of each abstract. This issue includes NAB numbers 1779 - 2285, which are tabulated below to facilitate use of the index.


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